WATER & SEWAGE WORKS

WATER SUPPLY • SEWAGE DISPOSAL

JULY 1956

"Operation Carp": A Fish-Story of Proportions
(See story . . . page 281)

Economic Evolution of Crude Sludge Filtration

Selecting Valves for Water Service
(A prize winning paper)

NO MATTER HOW YOU FIGURE IT...

When you undertake the purchase of a new pipeline for your water supply system, do you figure from the financial angle—low first cost, economical installation and a long life for your investment?

Or are you more interested in the construction of the line—minimum excavation, easy assembly, and watertight joints in a pipe strong enough to withstand high pressures and heavy external loads?

Then, again, your specialty may be maintenance. In that case you probably figure minimum repairs through freedom from breaks and leaks to be of paramount importance.

Or is your main concern with operation? If so, you no doubt figure permanent high carrying capacity, low pumping costs and trouble-free service to be vital.

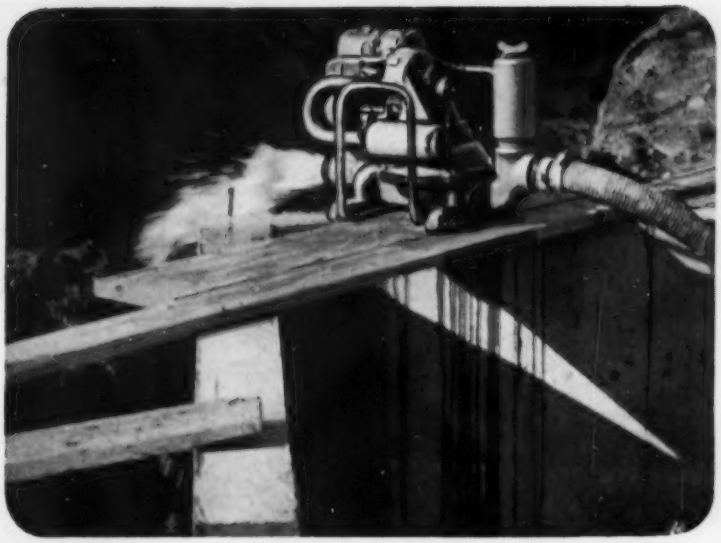
Still, *no matter how you figure it*, your best answer will always be LOCK JOINT CONCRETE PRESSURE PIPE, because it most nearly approximates the ideal pressure pipe for water works systems.

LOCK JOINT PIPE CO.

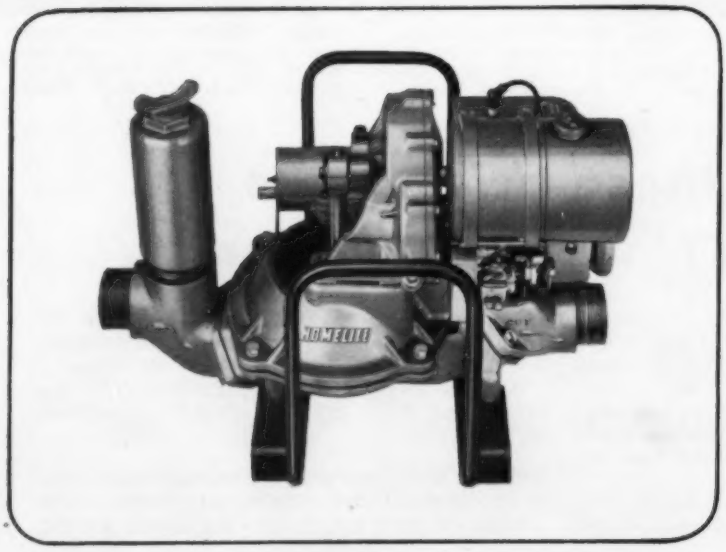
East Orange, New Jersey

Sales Offices: Chicago, Ill. • Columbia, S. C. • Denver, Col. • Detroit, Mich. • Hartford, Conn. • Kansas City, Mo.

Pressure • Water • Sewer • REINFORCED CONCRETE PIPE • Culvert • Subaqueous



It's here!
The new heavy-duty diaphragm pump that's light enough to carry



Here's the diaphragm pump that goes most easily to the job and does more when it gets there. Specifically designed for continuous, heavy-duty work, this Homelite pump will dewater an area at a 5000 g.p.h. clip, then keep right on going to handle seepage in the thickest mud, muck and sand. Yet, because it weighs only 120 pounds, it gets to the job fast . . . even over the roughest terrain.

The entire unit is built for long, trouble-free operation. Manual throttle control adjusts engine speed for full-capacity pumping or handling small seepage flow . . . gives greater fuel economy and prolongs engine life. Ball and roller bearings protect engine and pump from excessive wear. Totally enclosed reduction gears run in oil. Tough, oil-resistant diaphragm can be easily replaced in ten minutes right on the job.

For more information or a demonstration on your job, write or call your nearest Homelite representative.

NEW HOMELITE
Carryable
DIAPHRAGM PUMP

Model 20DP3-1 has guaranteed total lift up to 28′ and total head up to 50′, including friction.

HOMELITE

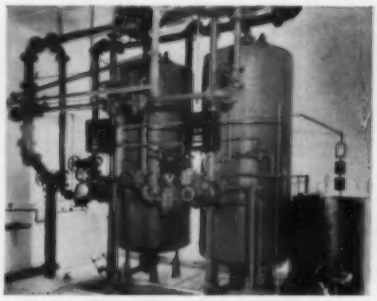
A DIVISION OF TEXTRON, INCORPORATED
707 RIVERDALE AVENUE
PORT CHESTER, NEW YORK

TURBIDITY gets cut from 1500 to less than 5 ppm in this Precipitator. Mt. Carmel, Ill. Cons. Eng.: *Warren & Van Praag, Inc.*

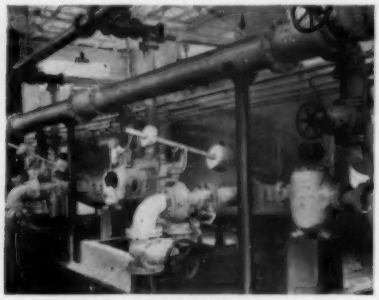
SEA WATER saves $32,980 per year over salt for regenerating Softeners. Hollywood, Fla. Cons. Eng.: *Reynolds, Smith & Hills.*

30 PPM IRON gets cut to 0.14 ppm in Aerator and Precipitator . . . even before filtration! Fairless Hills, Pa. Cons. Eng.: *H. H. Le Van, Jr.*

HARDNESS TESTER starts regeneration of softeners automatically, saves manpower. E. Aurora, N. Y. Village Eng.: *E. J. Maurer.*



269 PPM HARDNESS is removed by these automatic Softeners. Aerator and Filters cut iron. Martinsville, Ill. Supt.: *O. Wiser.*



AUTOMATIC CONTROLS backwash, regenerate, rinse and return Softeners to service. New Smyrna Beach, Fla. Cons. Eng.: *Russell & Axon.*

OLD SETTLING BASINS house these modern Precipitators that boost capacity. North Kansas City, Mo. Cons. Eng.: *C. A. Haskins.*

SOFTENER CAPACITY TRIPLED and $7,000 yearly saved on salt by change to Permutit Q resin. Normal, Ill. Cons. Eng.: *Farnsworth & Conley.*

TRIPLE TROUBLE! 275 ppm hardness, 200 ppm alkalinity, 3 ppm iron are reduced by this Precipitator. Staples, Minn. Supt.: *E. H. Klang.*

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Some chose Permutit for its world-known engineering experience gained through thousands of installations covering every major development in clarification, filtration and softening equipment.

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WATER SUPPLY • SEWAGE DISPOSAL

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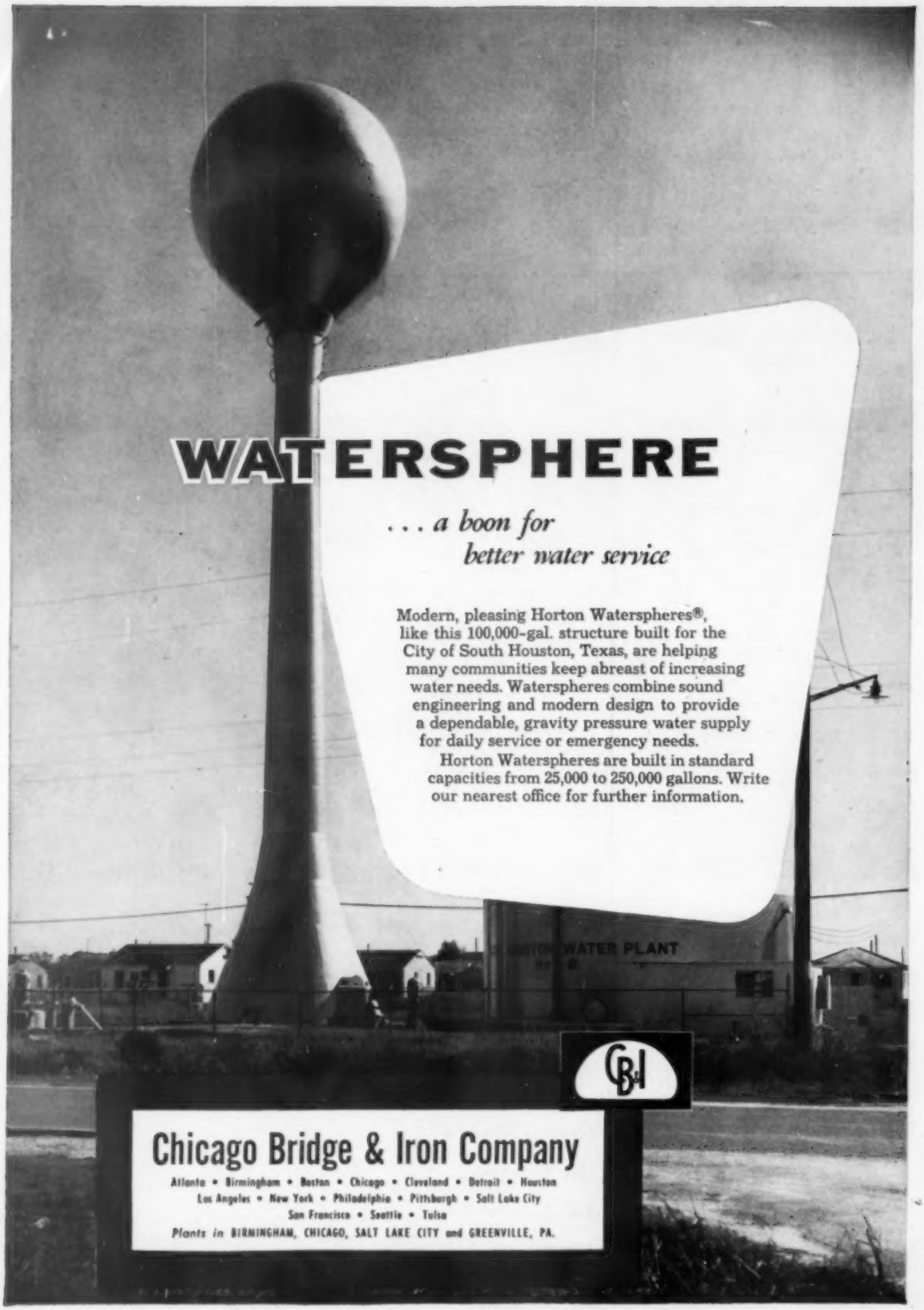
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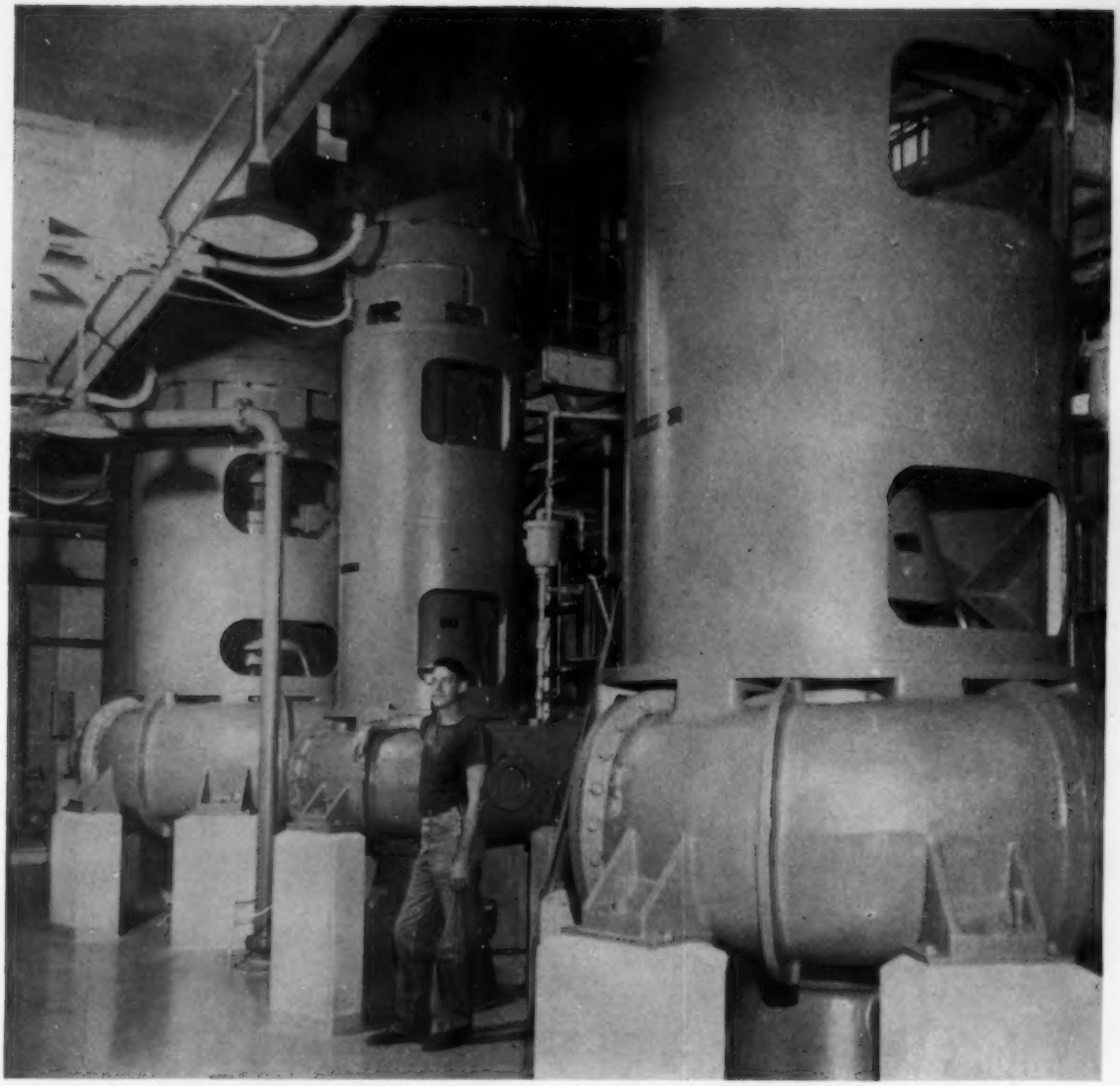

24", 30", and 36" Fairbanks-Morse "Angleflow" pumps in Tampa's Krause St. station. Consulting Engineer—Greeley and Hansen, Chicago.

Master Plan for Tampa

To eliminate a serious bay pollution problem, Tampa has expanded its sewage treatment and disposal facilities by doubling the area served and connecting a 78% increase in population. The $22 million investment includes a 36 m.g.d. treatment plant, six new pumping stations with 27 new Fairbanks-Morse sewage pumps. There are pumps in the Fairbanks-Morse line to move any magnitude of municipal water supply at any appropriate pressure, and other pumps to meet ordinary or unusual problems of wastes treatment and disposal. A Fairbanks-Morse hydraulics engineer will be happy to work with your consulting engineer in specifying the right pump for your specific job. Fairbanks, Morse & Co., Dept. WSW-7, 600 So. Michigan Ave., Chicago 5, Ill.

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"We can't swim here, Orgie, the water's been treated with PITTCHLOR®!"

Yes, and it's getting more and more difficult for microorganisms to find suitable swimming places these days since so many water treating and sewage plants have started using Pittchlor. Chlorine-susceptible bacteria and algae perish instantly in Pittchlor-treated water.

A stable, high-test calcium hypochlorite containing a minimum of 70% available chlorine, Pittchlor works fast and effectively in chlorinating water supplies, treating sewage or wherever the germicidal and deodorizing action of chlorine is needed.

Pittchlor is dry, white and free-flowing. Its granular form permits ease of application either manually or by mechanical feeders. Write for free folder.

For water purification, sewage treatment, and swimming pool sanitation

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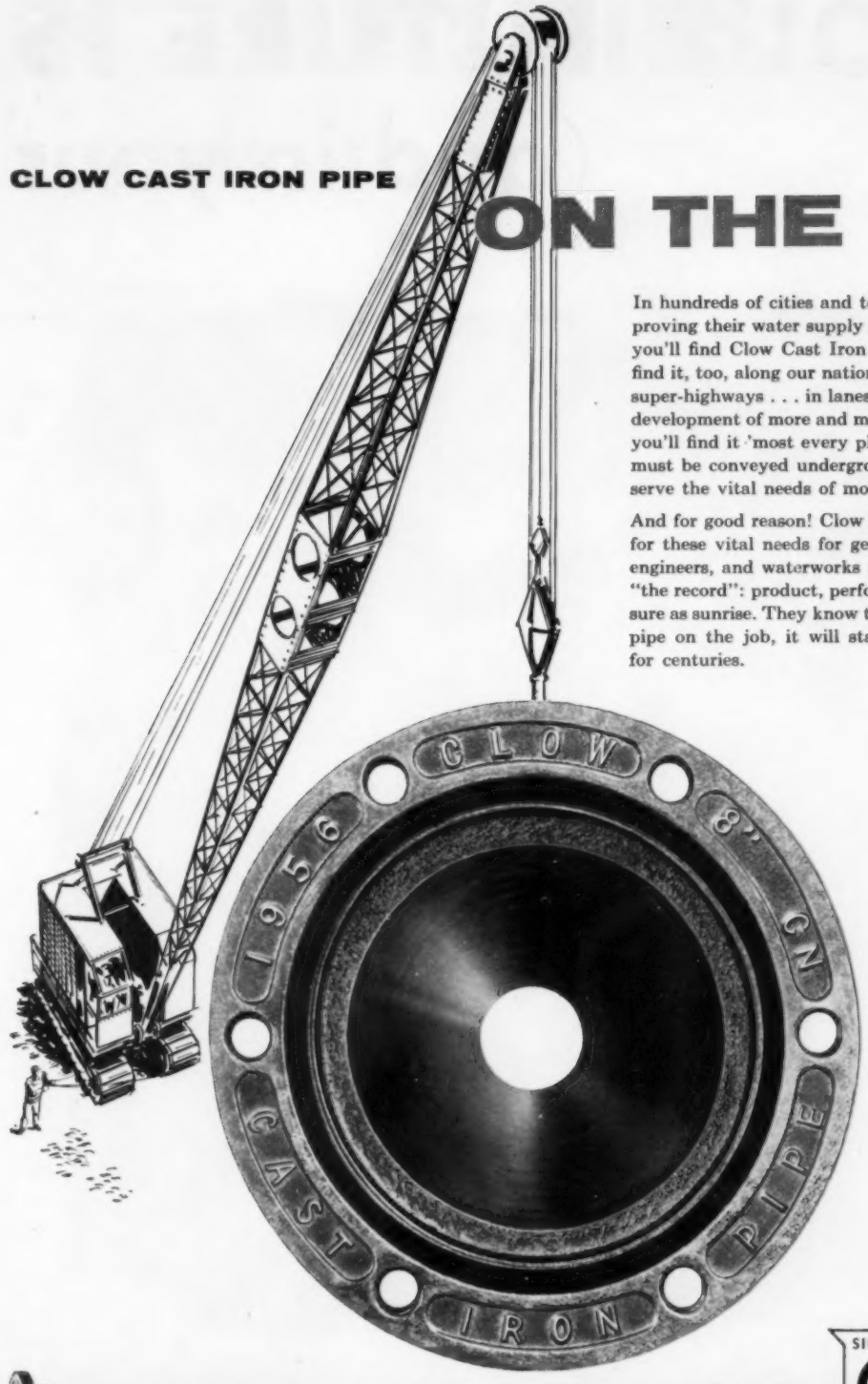
In hundreds of cities and towns expanding and improving their water supply and distribution service, you'll find Clow Cast Iron Pipe on the job. You'll find it, too, along our nation's newest toll roads and super-highways . . . in lanes and by-ways . . . in the development of more and more communities. In fact you'll find it 'most every place . . . wherever water must be conveyed underground, under pressure, to serve the vital needs of modern life.

And for good reason! Clow has been supplying pipe for these vital needs for generations. City officials, engineers, and waterworks men like what they call "the record": product, performance-proved; service, sure as sunrise. They know that when they put Clow pipe on the job, it will stay on the job—to serve for centuries.



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IN THE SKIES... hands, too)

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Our national advertising stresses advance planning of water facilities... warns millions of Americans—homeowners, apartment dwellers, industrialists about waste, pollution, the need for efficient water systems. It points out the need for new water sources, adequate treatment and distribution, realistic water rates, far-sighted water legislation . . . all the facts the public must know to cooperate intelligently with you and your fellow water officials in your difficult job of keeping America plentifully supplied with water—now and in the future.

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For over 70 public utilities in the United States and Canada, cast iron mains laid over a century ago are still serving dependably. This long, trouble-free service means lower maintenance costs... fewer tax dollars expended... fewer headaches for the waterworks officials who specify cast iron.

And today, modernized cast iron pipe, centrifugally cast, is even more rugged, uniform, durable. When needed, it's available with cement-lining to assure sustained carrying capacity throughout its generations of service.

The next time you plan extensions to your distribution system remember, cast iron pipe means the ultimate in long term reliability and economy.

Cast Iron Pipe Research Association, Thos. F. Wolfe, Managing Director, 122 So. Michigan Ave., Chicago 3, Illinois.

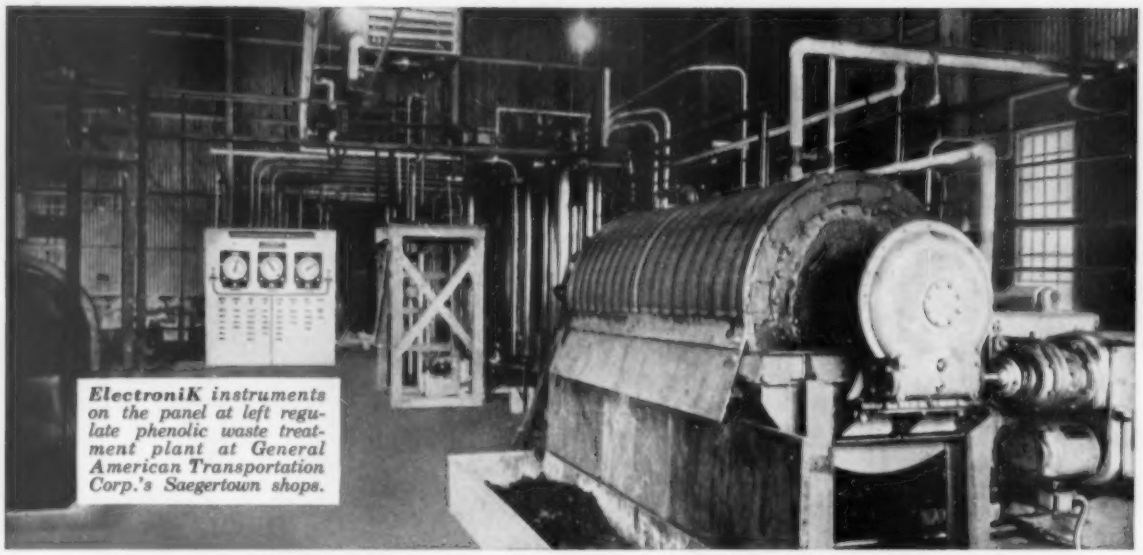
This rugged old cast iron water main, still serving and saving tax dollars for the citizens of *Detroit, Michigan,* is now in its 115th year of dependable service.

CAST Q IRON

The Q-Check stencilled on pipe is the Registered Service Mark of the Cast Iron Pipe Research Association.

pipe FOR MODERN WATER WORKS

You can treat toxic wastes continuously under control of *ElectroniK* instruments



***ElectroniK** instruments on the panel at left regulate phenolic waste treatment plant at General American Transportation Corp.'s Saegertown shops.*

ARE YOUR wastes toxic? The economical way to convert them to safe effluent is through continuous treatment. And the effective way to operate a continuous system is to use *ElectroniK* instruments.

Here's how it works at the Saegertown, Pa. plant of General American Transportation Corporation. Wash waters from railway tank car cleaning operations often contain phenol and other toxic ingredients, which must be removed before discharge to a nearby river. A continuous system treats some 50,000 gallons of waste daily, by a combination of adsorption, flotation, flocculation and biological oxidation.

Several *ElectroniK* pH controllers play important parts in the system. These instruments control the flow of acid or alkaline reagent to maintain exactly the right pH for the treatment processes. Their close, sensitive control enables the system to reduce the phenol content to minimum approved levels in the final effluent. Moreover, this particular treatment plant is so thoroughly automatic that a single operator can handle the complete supervisory job.

Your nearby Honeywell sales engineer will be glad to discuss how modern *ElectroniK* instrumentation can cut costs in your own water or waste treating processes. Call him today for a consultation . . . he's as near as your phone.

MINNEAPOLIS-HONEYWELL REGULATOR CO., *Industrial Division*, Wayne and Windrim Avenues, Philadelphia 44, Pa.—in Canada, Toronto 17, Ontario.

● **REFERENCE DATA: Write for Catalog 1551, "pH and Conductivity Instrumentation."**

MINNEAPOLIS **Honeywell**

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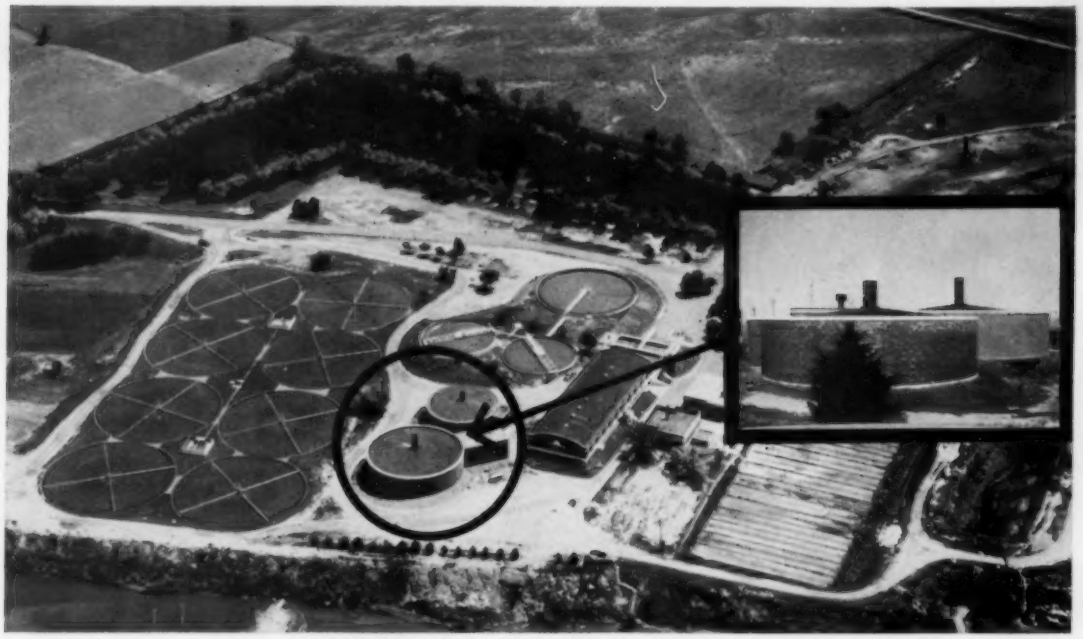
First in Controls

Circled area shows 2 PFT Floating Covers—long building to the right contains 5 rectangular PFT Floating Covers



Lincoln, Nebraska continues modernizing

WITH PFT "CONTROLLED DIGESTION"

This unusual trickling filter plant at Lancaster Sanitary District #1 in Lincoln has undergone 3 major expansions in 18 years. It provides an excellent example of building for modern treatment on the base of full utilization of existing structures.

In its 1937 expansion, the District converted 5 small rectangular Imhoff Tanks into digesters, installing a *PFT Floating Cover* on each. Floating Covers were chosen for their positive scum submergence, flexibility of operation and safe utilization of gas.

Another digester was added in 1941 — a 65′ circular digester, again equipped with PFT Floating Cover along with PFT Gas Safety Equipment.

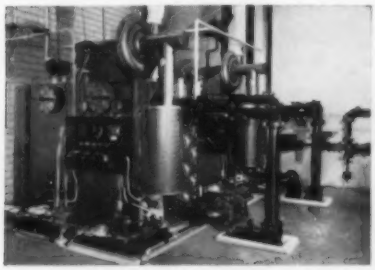
Lincoln's latest expansion came in 1953 when an 85′ diameter digester with PFT Floating Cover was installed.

In addition, a *PFT Heater & Heat Exchanger* unit was added (750,000 B.T.U. per hr.) for efficient and economical sludge heating. Fired by the sludge gas itself, the heater consumes the absolute minimum of purchased fuel.

A well planned gas safety system was also installed in 1955, including the following PFT equipment: Waste Gas Burners; Flame Trap; Pressure Relief with Flame Trap; Drip Taps; Auxiliary Flame Cell; Gas Check Valves; Gas Pressure Gauge.

Congratulations to Lincoln on making excellent use of older equipment in building a highly modern, efficient plant!

Design of plant by / *Black & Veatch, Consulting Engineers, Kansas City, Mo.*



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waste treatment equipment exclusively since 1893

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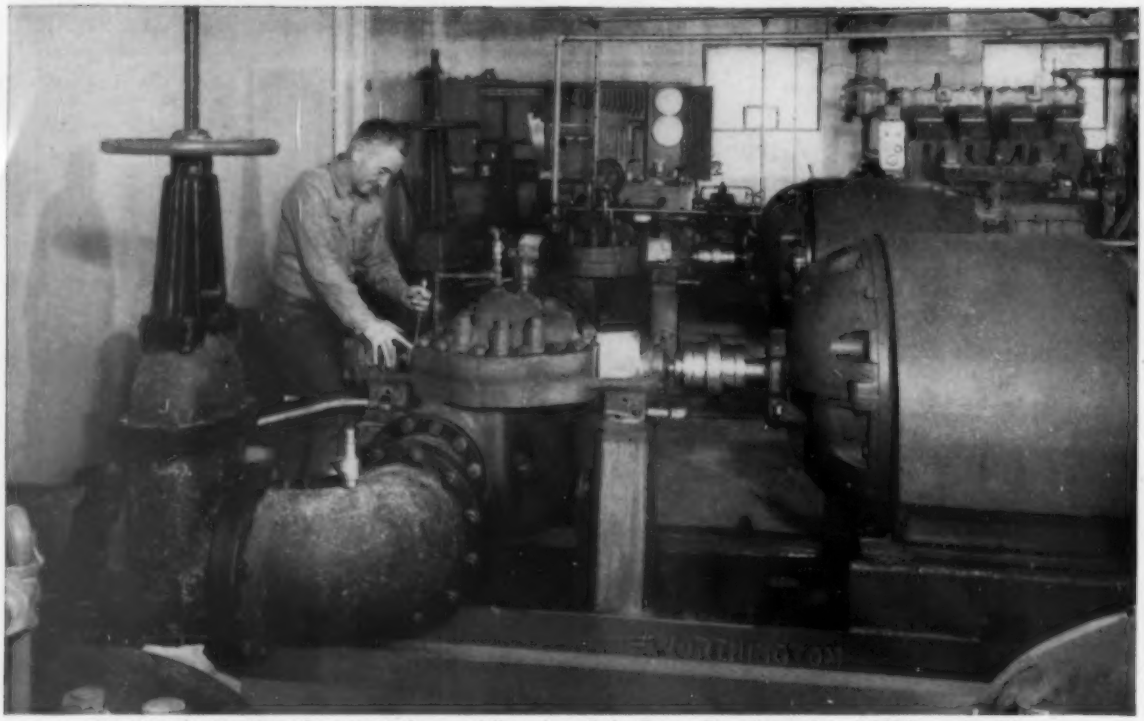

SIX MILLION GALLONS of water per day are delivered to City of Colorado Springs by three Worthington 400-hp centrifugal pumps, like that in foreground, at Lake George Pumping station. A 200-hp engine-driven Worthington is on standby service. This installation was engineered by Black and Veatch Co. of Kansas City, Mo.

15 Worthington pumps supply water to fast-growing Colorado Springs

THREE 300-HP WORTHINGTON vertical turbine pumps move well water from common sump to Colorado Springs' Fort Carson supply line.

A population up 50% in 10 years, an expanding industry, the new Air Force Academy—all these have spurred the demand for water in the City of Colorado Springs.

The job of supplying the city with an additional 6 million gallons of water a day falls to the Worthington-equipped Lake George and Secondary Pumping stations. Together, these stations pump water through a total pipeline distance of 92,810 feet with a lift of 1,580 vertical feet. Each station contains three 400-hp Worthington centrifugal pumps each of 2-mgd capacity. A 200-hp gasoline-engine-driven pump on standby service in each station provides minimum flow in case of power failure to prevent possible freezing of the lines.

Colorado Springs also obtains water from Fountain Creek Valley. This water is pumped to a common sump by four 30-hp pumps and from the sump to the distribution system by three 300-hp pumps—all seven pumps being Worthington vertical turbines.

The Colorado Springs water works installation is typical of thousands using rugged, reliable Worthington public works equipment—pumps, engines, compressors, turbines. Worthington engineers will be glad to help you apply this equipment to *your* water works or sewage needs. Write Worthington Corporation, Public Works Division, Harrison, N. J. W. 6. 1

WORTHINGTON

ALL MAJOR PUBLIC WORKS EQUIPMENT UNDER ONE RESPONSIBILITY

Water Works Pumps • Sewage Pumps • Comminutors • Vertical Turbine Pumps • Vacuum Pumps

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Ingenuity of Water Officials Restores Purity and Clarity Economically

When excessive turbidity seriously threatened Hodges reservoir, San Diego Water Department engineers solved the problem quickly and ingeniously in a single, economical operation.

Careful survey indicated the trouble was the extraordinary number of carp rooting in the mud bottom. The solution? Kill the carp and save the water! The most effective fish toxicant was sought. From Fish and Game Commissions, Water, Health and Conservation Departments across the country came the answer—Penick's Pro-Noxfish.

The operation was successful in every way. In less than six hours spraying and only a few days mopping up, the entire carp population was eradicated and the high quality of Hodges water was restored.

The exceptional efficiency of Pro-Noxfish is due to the combination of rotenone with Penick's synergist, Sulfoxide,** which multiplies the potency and lowers the cost. A special emulsifier in Pro-Noxfish quickly disperses it throughout the entire body of water for fast and complete action. Pro-Noxfish is easy to use, requires no unusual equipment.

Additional information is readily available to interested officials. Write attention Pesticide Department or use the coupon below.

PRO-NOXFISH contains:

Sulfoxide	2.5%
Rotenone	2.5%
Cube and Derris Root Extractives	5.0%
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World's Largest Manufacturer of Fish Toxicants

For the complete story of how Pro-Noxfish saved San Diego's Hodges Reservoir, see Page 281

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FAIRFAX, VIRGINIA. Steel standpipe, 900,000 gallons capacity. Diameter 48 ft., head range 67 ft.

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for maximum economy in better water supply

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The strength, endurance and low cost of Pittsburgh-Des Moines All-Steel Reservoirs and Standpipes meet every requirement of service and economy wherever terrain is advantageous. A wide range of standard and special designs is available, fabricated and erected with skill and experience. *Let us quote on your projected needs.*

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DALLAS (1). . 1223 Praetorian Bldg.
SEATTLE . . . . . 526 Lane Street
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MADRID, SPAIN . . . Diego DeLeon, 60

Today's water Supply-

is your community's most valuable asset!

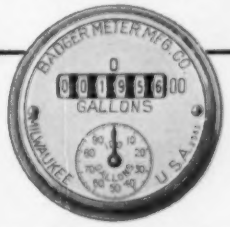
Badger Meters provide a precise check on usage and waste . . . first logical step towards conservation.

This perplexed citizen is a victim of water shortage — fast becoming a major problem in many communities. The tools he holds in his hands hardly equip him to fight for his rightful share — *he needs help from his water department.*

What YOU do *now* to safeguard *present water* supplies — to prevent situations like this —may play an important part in future development of your own community.

Metering all water for residential and industrial use is the first logical step towards knowing *where* and *how much* water is used—or wasted. Studies prove that water use in metered cities is reduced by as much as 33%.

Metering your water supply is a step made easy by the Badger Meter representative in your area. He can furnish complete data on many types of Badger Meters best suited for the specific needs of your community. For an appointment, at your convenience, write direct.



Fair rates for all users - greater income per year

One of the greatest "business machines" works for you — accurately and sensitively registering all flow. Large and small users alike pay fair shares to help keep water departments self-supporting.

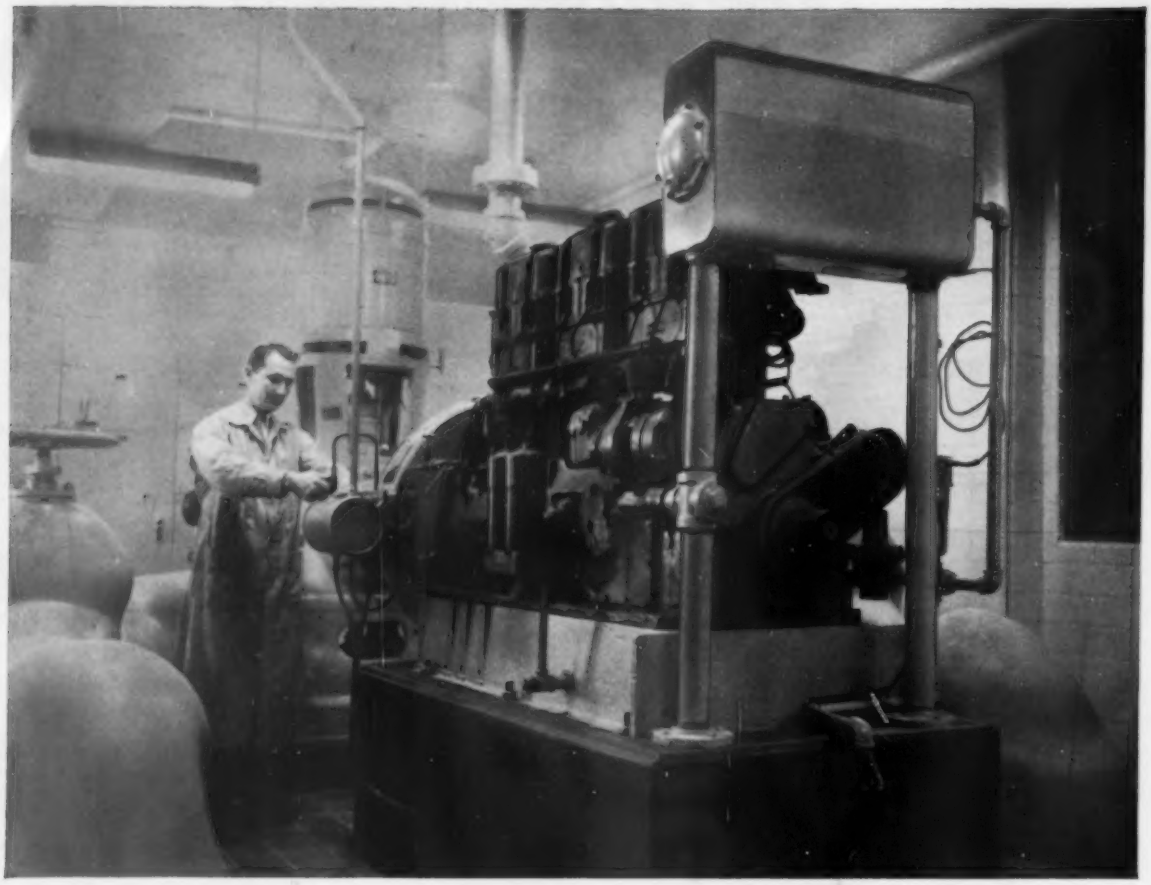
Durability, dependability and low maintenance costs make community ownership of Badger Meters an investment in economy that pays dividends over the years.

Badger Water Meters

Water is Vital

BADGER METER MFG. CO. • MILWAUKEE 45, WISCONSIN

"Badger Meters have conserved it for 50 years"



Standby...for Action

... the dependability built into Le Roi engines means that you have power when you need it most

The operator of the Le Roi F1500 shown above said, "This engine has surpassed our every requirement for standby power, and has more than paid for itself with dependable, economical, power production when we needed it most."

That's typical of the results experienced by Le Roi engine users everywhere. But you get more than just dependability. You get economy.

For example, Le Roi engines are so compact that you save on installation costs. Volume production and post-war designs give you more horsepower per dollar. Also, because Le Roi engines can use the lowest cost fuels available, savings in operating costs are important, too. We have some engines that have saved taxpayers over $4000 a year for 14 years — others that have saved $7600 in a 10-month period. And so it goes.

You, too, can save your taxpayers' money and still provide them with the services they need, by using Le Roi engines. Sizes range up to 645 hp, or in custom generator sets from 50 to 350 KW. And all Le Roi's operate on natural gas, LPG, gasoline, or no-cost sewage gas. Write us for our latest literature.

E-106

LE ROI *Division of Westinghouse Air Brake Co.*

Milwaukee 1, Wisconsin

PORTABLE AIR COMPRESSORS TRACTAIR STATIONARY AIR COMPRESSORS AIR TOOLS ENGINES

YOU BUY FULLEST INTER-CHANGEABILITY OF Working Parts

When you buy Advanced-Design AMERICAN METERS

It has always been a company policy that all internal parts of American Meters must be interchangeable. Not interchangeability of costly unit assemblies but interchangeability of single inexpensive parts. In the solid casing or frost-bottom American Meters the works are exactly the same . . . Old Meters can be modernized by substituting late model parts, bringing them up-to-date in performance and accuracy.

BUFFALO METER CO.
2909 Main Street Buffalo 14, N. Y.

Begin NOW to keep your department free of obsolete Meters . . . Buy American.

Rough Going At Indianapolis

All wasn't peaches and cream when Columbia Construction installed 8000 feet of 36-inch pipe for the Indianapolis Water Company along White River Parkway in the Hoosier capital.

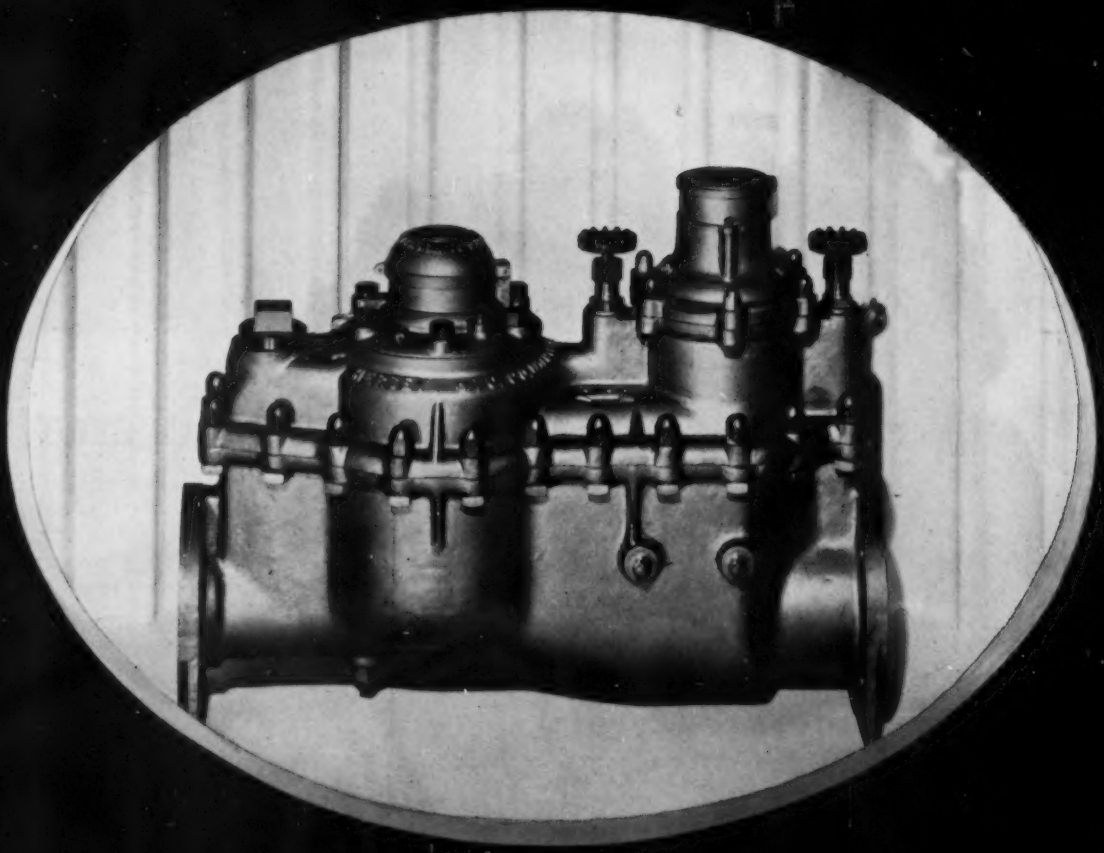
This picture shows where the line crossed 10th Street. A telephone conduit was supported with a timber thrown across the ditch, a 10-inch gas main crossed just below, and unstable soil kept filling the bottom. A 2-foot deflection was called for here and the contractor had to duck down under the existing utilities as well. Also, a tie-in was made with an 8-inch water main on 10th Street not shown in the picture.

"Although this was the first time we had installed a water line of concrete pressure pipe down city streets," reported Carl F. Kortepeter, engineer for Columbia Construction, "the steel and rubber joint made the pipe easy to work with. The 10th Street crossing wasn't too unusual and we used a couple of bevels to make our 2-foot deflection, then rotated one of them slightly to drop down enough to clear a gas main. Another bevel adapter or two brought us back on line."

The bevel adapters Mr. Kortepeter refers to are specials made up of a bell ring and a spigot ring set back to back at an angle of 2° or 4° and are kept on the job to handle such situations. The pipe on this job was prestressed concrete cylinder pipe and was supplied by Price Brothers Company with plants in Dayton, Cleveland and Miami.

Price

HERSEY



HERSEY COMPOUND METERS

ALL BRONZE CASE 2" TO 6" INCLUSIVE

69 years of successful experience and engineering skill is back of every water meter made by the

HERSEY MANUFACTURING COMPANY

SOUTH BOSTON, MASS.

BRANCH OFFICES: NEW YORK — PORTLAND, ORE. — PHILADELPHIA — ATLANTA — DALLAS — CHICAGO
SAN FRANCISCO — LOS ANGELES

OLIVER 88 WT HYDRO-TRENCHER

"Outperforms any other trencher in this area!"

After digging 9,500 ft. of sewer line trench averaging 8 ft. deep in the toughest gumbo found anywhere in Western Canada, W. N. Schmidt of Ideal Plumbing and Heating Co., Ltd., of Regina, Saskatchewan, has this to say: "Our experience with the Oliver 88 Hydro-Trencher has been excellent. It will outperform any other trencher we've ever seen in this area."

And hear what he has to say about year 'round operation: "Working through the winter, we operated in temperatures as low as 20° below zero and were able to dig through 4 ft. depth of frost!"

The Hydro-Trencher is designed for tough assignments like this. Tremendous down pressures enable you to force the bucket through the hardest soils. And dual hydraulic controls give you the speed and easy handling to make fast work of any job.

Plumbing contractors, general contractors and public bodies everywhere are profiting handsomely with this dependable, high production tool. So can you. Ask your Oliver dealer to demonstrate.

The Oliver Hydro-Trencher with ½-yd. bucket digs to 12 ft., loads to 12 ft. and provides 180° boom swing to either side; moves quickly from job to job under its own power.

THE OLIVER CORPORATION
400 West Madison Street, Chicago 6, Illinois

OLIVER

a complete line of industrial wheel and crawler tractors and matched allied equipment

DRY HTH®

...the best solution for all water treatment problems

When it comes to water treatment, nothing equals HTH for convenience, effectiveness and efficiency.

As a dependable *rated* source of chlorine, HTH is the best product of its kind. It contains 70% available chlorine. It's dry, granular, non-dusty, fast dissolving. It's clean and white . . . yields clear solutions. HTH is stable, too, and you'll find it easy to store without extra care or precautions on your part.

Use HTH in tablet form if you require a slower dissolving source of chlorine—one which will maintain chlorine residual over a long period of time (for example, sanitizing new pipe lines).

Both HTH Granular and HTH Tablets are available in 100-lb. drums and in cases of small-size cans. For more detailed information, just call your HTH supply house or mail the coupon below.

3506

MATHIESON

OLIN MATHIESON CHEMICAL CORPORATION
Industrial Chemicals Division
Baltimore 3, Maryland

Please send complete information on HTH for water treatment applications.

Name_____

Company_____

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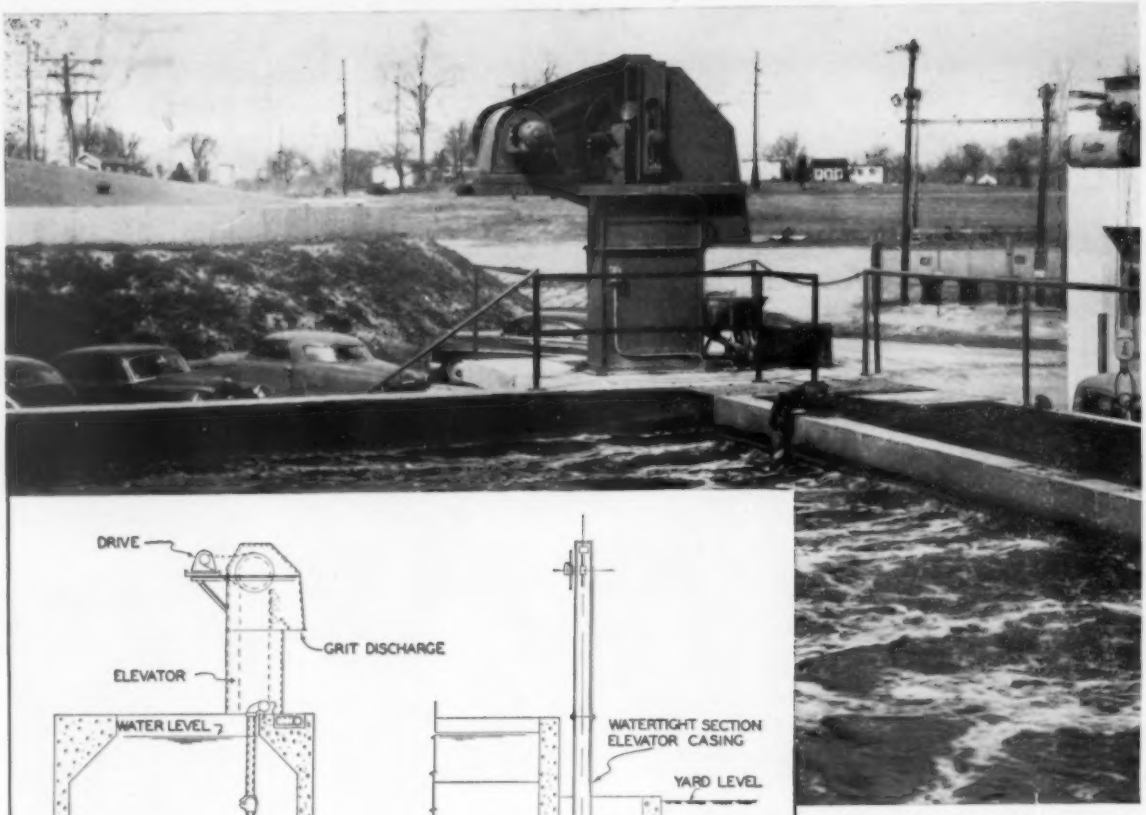

The grit basin is rectangular with a sloping bottom to collect the grit under the diffuser tubes. Below the water line, housing of the elevator and spiral conveyor is watertight. The spiral passes through a short tube between the grit chamber and the elevator to prevent grit from passing directly into the elevator boot.

This **JEFFREY** Grit Collector was designed especially for small treatment plants and aerated grit channels

● Grit is allowed to accumulate to considerable depth. Then the elevator is started and run until all grit is removed. The design is such that the spiral acts as a feeder to the elevator, delivering grit only as fast as the elevator can remove it. Can be used either in plain or in aerated grit channels.

Treatment plants throughout the country are Jeffrey equipped—in villages, towns and cities, serving 1500 to several millions; at industrial plants, airfields and similar projects. Jeffrey sanitation engineers offer you complete technical information on plant design and equipment.

Catalog 905 describes Jeffrey sanitation plant equipment. The Jeffrey Manufacturing Company, Columbus 16, Ohio.

JEFFREY

CONVEYING • PROCESSING • MINING EQUIPMENT • TRANSMISSION MACHINERY • CONTRACT MANUFACTURING

Installing 36-in. tar-enameled steel pipe in a wooded area northwest of Worcester.

20,000-ft steel main installed in Worcester

One of the biggest water-supply projects to be completed in New England in 1955 was the Worcester, Mass., high-pressure line. The design working pressures are 160 psi for the 36-in. ID section and 190 psi for the 30-in. ID section.

The steel main extends somewhat over 20,000 ft from the pumping station at Holden Reservoir No. 2 to a point near Indian Lake, where it connects with Indian Hill Reservoir. Its high capacity and great reserve strength make the line an important source of water for the present and future needs of industrial Worcester.

The line is 36 in. ID for some 14,300 ft from the pumping station to Grove Street, where it is reduced to 30 in. ID. Bethlehem supplied the pipe in easy-to-install 40-ft lengths, coated and lined with coal-tar enamel, and protected with felt and paper wrappings. Every length was hydrostatically tested in our shop in accordance with AWWA specifications. Field joints were made with Dresser couplings.

If you have a new large-diameter line in mind, we urge you to consider the many advantages of welded steel pipe. No other material can match steel pipe for strength, long life, resistance to damage, leak-proof joints and ease of installation. May we give you more information? Please contact the Bethlehem sales office nearest you.

Photographed on the job are (left to right) Fred Dodge, inspector for Metcalf & Eddy, Boston, design engineers for the project; Cliff Johnson, president of Johnson Brothers, general contractor: Joseph Flatley, inspector for Metcalf & Eddy; C. B. Hardy, Water Superintendent for the City of Worcester; Ernest Johnson, partner in Johnson Brothers.

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. *Export Distributor:* Bethlehem Steel Export Corporation

BETHLEHEM STEEL

BETHLEHEM STEEL

Palatability is in Good Taste

. . . and many water supplies to be made palatable, should receive adequate dosages of AQUA NUCHAR activated carbon. The amount of AQUA NUCHAR required varies with seasonal changes in algae and trade-waste concentrations, and with different methods of water purification. Frequent Threshold Odor Tests will indicate the amount of AQUA NUCHAR required to produce palatable water.

Our technical staff will gladly, without obligation, give your plant a complete odor survey and recommend how and where AQUA NUCHAR can best be used to produce palatable water.

GOOD CARBON · GOOD WATER · GOOD WILL

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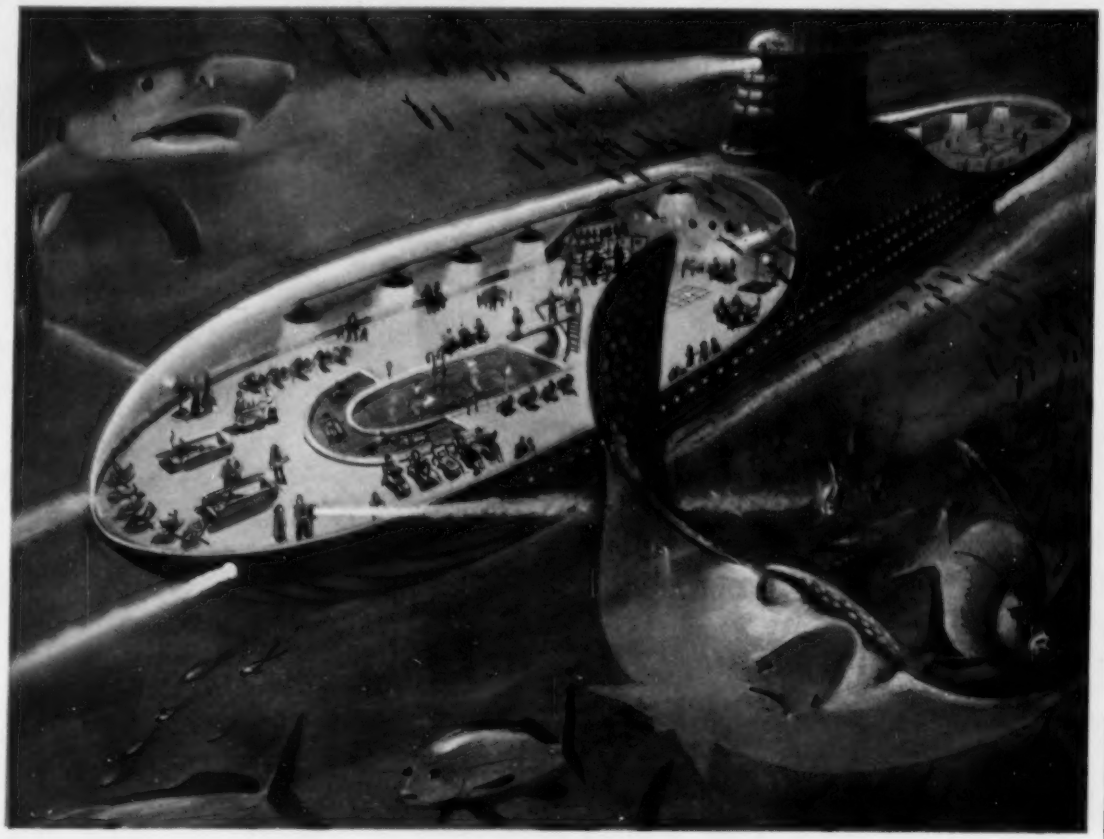
2775 S. Moreland Boulevard
Cleveland 20, Ohio



HUGE submarine liners with glass capable of withstanding tremendous pressure may offer the traveler of the future intimate glimpses of life under the sea and immunity from storms and seasickness.

100 years from now...

WE MAY SIGHTSEE UNDER THE SEA!

The world of the future—full of amazing, time-saving, health-giving products and machines. Still being used, however, will be the reliable cast iron water and gas mains laid today.

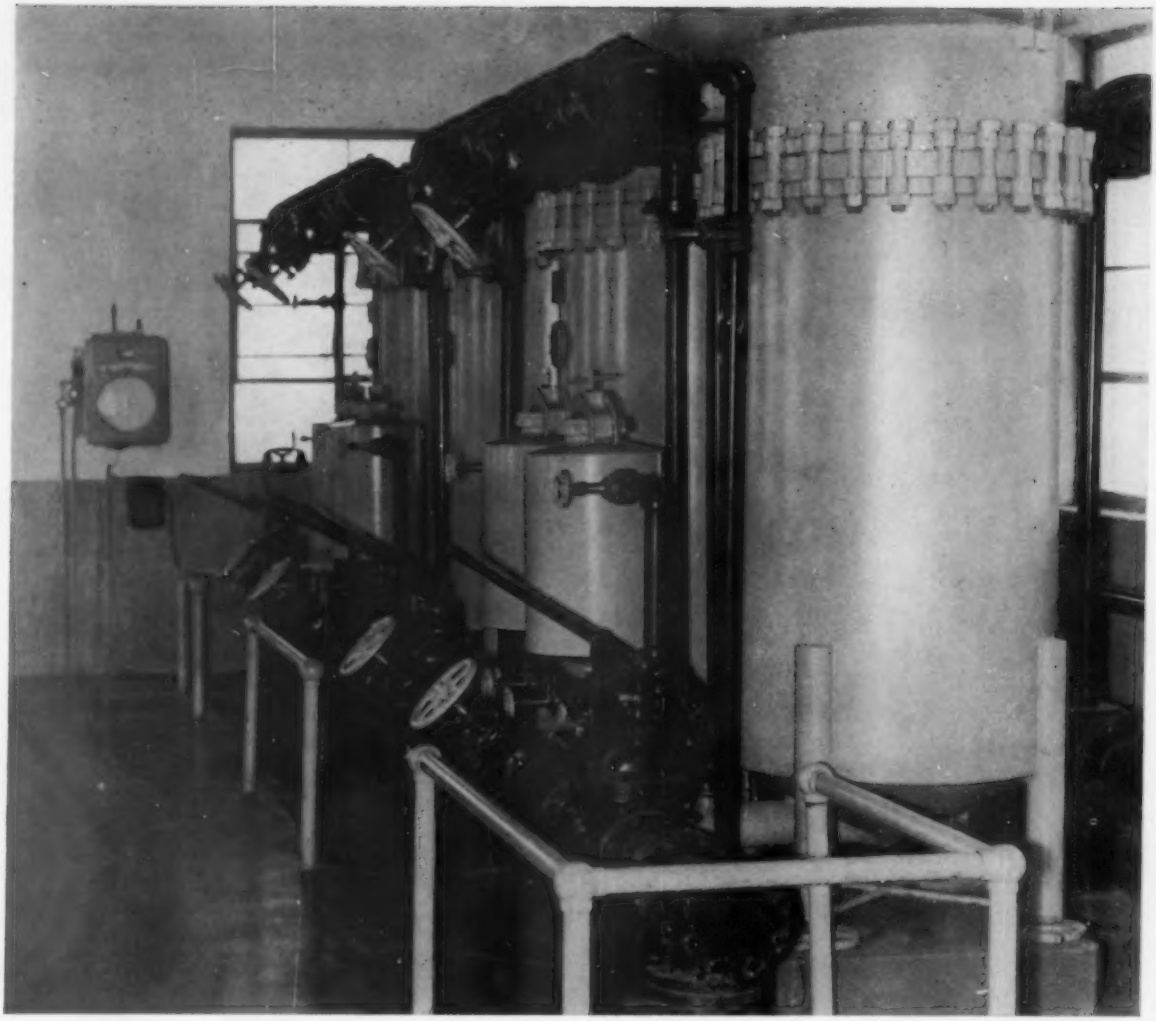
Records show that over 60 American cities from coast to coast are still served by cast iron water and gas mains laid more than a century ago. And modernized U. S. Pipe... centrifugally cast, quality-controlled from mines to finished product...is extra rugged, more dependable than ever.

U. S. Pipe is proud to be one of the leaders in a forward-looking industry whose service to the world is measured in centuries.

U.S.
cast iron
PIPE
FOR WATER, GAS, SEWERAGE AND INDUSTRIAL SERVICE
CAST IRON

U. S. PIPE AND FOUNDRY COMPANY, General Office: Birmingham 2, Alabama

A WHOLLY INTEGRATED PRODUCER FROM MINES AND BLAST FURNACES TO FINISHED PIPE.



PROPORTIONEERS INC. DIATOMITE FILTERS at Tupper Lake, N. Y., which use...

ALOXITE® tubes for most efficient service

Water supply for the town of Tupper Lake, N. Y., is filtered by the diatomite filters shown above. Manufactured by Proportioneers Inc. of Providence, R. I., they use ALOXITE® aluminum oxide porous tubes as the support septa.

These filters have demonstrated that ALOXITE tube septa are highly economical, and give consistently satisfactory performance. The reasons for their superiority in diatomite filtering stem from many inherent advantages. For example, a high percentage of their total area is pore area. Pre-coat builds up evenly on their uniform structure. Backwash is effective and accomplished with a high degree of uniformity. ALOXITE septa alone will even give partially effective emergency filtration. And they resist acids, which permits cleaning of units clogged by iron and other materials.

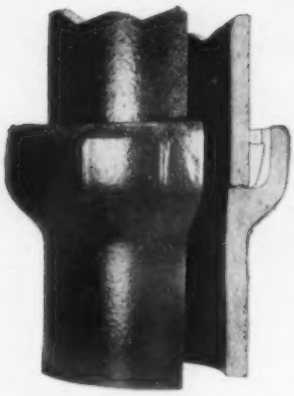
This informative 56 page booklet describes porous media for all fields of filtration and diffusion. Write us for your free copy today.

CARBORUNDUM

Registered Trade Mark

Dept. 776, Refractories Division, Perth Amboy, N. J.

AMVIT* JOINTED CLAY PIPE gains wide acceptance, more than 60 major installations completed in 1955



Never before has a new product gained such wide acceptance and usage in such a short period of time.

In the first year since Amvit Jointed Clay Pipe was introduced more than 60 major installations have been completed with outstanding results. Such pioneer cities as Dayton, Ohio, Camden, New Jersey, Ostego, Michigan, Victor, New York, have installed their second and third Amvit Jointed sanitary lines.

Prevents Infiltration

Field tests from these installations show that ground water infiltration can be controlled and prevented—thus reducing pumping and treatment plant costs. Amvit is a compression type joint on the ball and socket principle. Nothing can enter the line after it is complete.

Quick Installation Saves Labor

Since no other material such as caulking, joint compound, hot-pots or ladles are needed to make the Amvit Joint, installation is quick and easy. The joint is on the pipe delivered to the job ready to use. Savings with Amvit Jointed Clay Pipe mean *lower cost of pipe in place* when the line must meet a rigid test.

Amvit Jointed Clay Pipe, in sizes 4" through 24", together with all fittings is available for immediate delivery in the Northeast and Central States.

For more information, write or call American Vitrified Products Company, National City Bank Building, Cleveland, Ohio, or our office nearest you.

Indiana

New Jersey

Michigan

Wisconsin

Illinois

*T. M. Registered. Patents Pending.

SINCE 1900

American Vitrified Products Company

CLEVELAND, OHIO

MANUFACTURERS of: Clay pipe, flue liners, clay liner plates and concrete pipe.

Plants Across the Nation... Brazil, Indiana • Chicago, Illinois • Cleveland, Ohio • Crawfordsville, Indiana • Detroit, Michigan • East Liverpool, Ohio Fenton, Michigan • Grand Ledge, Michigan • Lisbon, Ohio • Los Angeles, California • Milwaukee, Wisconsin • South Bend, Indiana • Uhrichsville, Ohio

NOW!

A BRAND-NEW CONCEPT IN FLOW TOTALIZING!

. . . THE NEW FOXBORO PNEUMATIC FLYBALL INTEGRATOR

Inherently Accurate!

- Eliminates Inaccurate "Spot Check" Counting! Continuous integration assures highest precision.
- Eliminates Cam and Linkage Errors! Unique design balances differential pressure signal directly against centrifugal force.
- Eliminates Calculations! Automatically extracts square root — shows totals in desired units.
- Eliminates Fire and Explosion Hazards! Simple, all-pneumatic operation requires no electric motors, wires, or contacts.

FOXBORO
REG. U.S. PAT. OFF.

Now you can integrate the flow of all process fluids or plant services *continuously* . . . with new accuracy . . . complete safety! The unique new, all-pneumatic Foxboro Flyball Integrator completely eliminates intermittent counting and fire hazard. Its simple, force-balance operation utilizes the 3-15 psi air signal from any differential-pressure flow transmitter. This signal is *continuously* balanced against the "flyball" force of the instrument's pneumatically-driven turbine. The square root function is automatically extracted . . . you read flow totals *directly*.

The Flyball Integrator mounts at the point of measurement or on a panel hundreds of feet away. Response and accuracy are completely unaffected by ambient temperature changes or pressure changes in turbine air supply. Ideal solution to all plant fluids accounting and in-process inventory checking. Write for complete details. The Foxboro Company, 899 Neponset Ave., Foxboro, Mass.

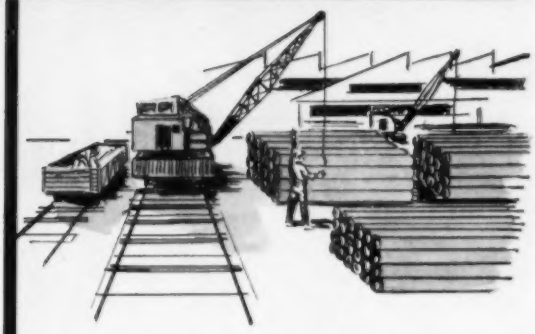
FIRST IN FLOW

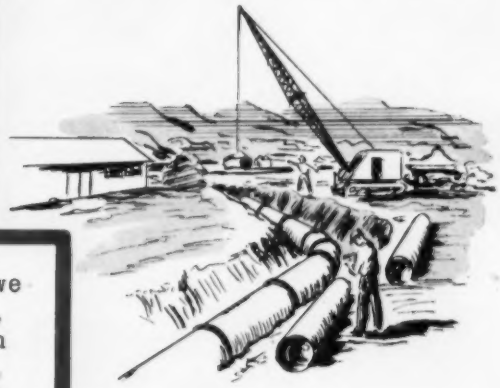
"...in strict accordance with orders and specifications."

Water specialists have tough jobs. Obtaining, treating, and supplying water requires constant care and exacting engineering from initial survey to final installation.

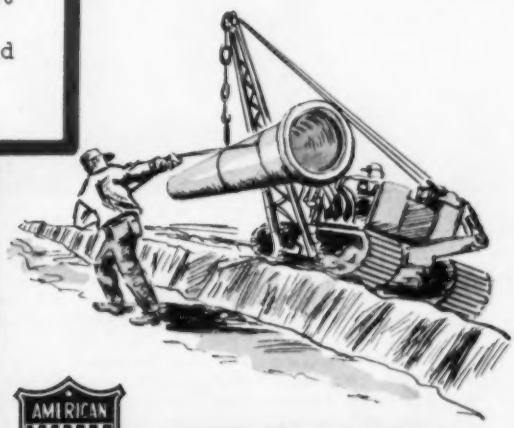
American Cast Iron Pipe Company service makes these and other tough piping jobs easier by supplying the exact pipe each job requires . . . when and where it is required . . . without excessive cost.

A long-time American Cast Iron Pipe Company customer writes:





"During the thirty-three years that we have done business with your company, we have not only found your prices in line, but you have without exception, lived up to your promises of shipment and have supplied your materials in strict accordance with our orders and the requirements of engineers' specifications."



This letter reflects the careful attention to orders and specifications that is characteristic of American Cast Iron Pipe Company service.

Your orders will receive the same exacting attention . . . the same superior service. Specify American Cast Iron Pipe.

AMERICAN

AMERICAN CAST IRON PIPE CO.
BIRMINGHAM 2, ALABAMA

SALES OFFICES

New York City	Los Angeles
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Minneapolis	Cleveland
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The man who named Tombstone, Arizona

THE SURPRISED government scout from Camp Huachuca reined his horse to a stop at the sight of Ed Schieffelin. And when Schieffelin admitted he was actually living and prospecting in Apache country, the scout warned him, "All you'll ever find'll be your tombstone."

But Schieffelin didn't scare easy. When he struck a silver lode in the desolate, dangerous hills of Arizona Territory, he called his first mine "Tombstone." And, unknowingly, he gave a name to a borning, brawling community soon to be notorious as one of frontier America's tough towns.

The Tombstone mine itself never amounted to anything. But Schieffelin just kept on prospecting — and within a few years, he turned out to be a millionaire. The hills he had risked his life in were practically made of silver.

Today's Ed Schieffelins are hunting uranium ore with Geiger counters, but their spirit is the same. And it is only part of the spirit of 165 million Americans who stand behind U. S. Series E Savings Bonds—who, by being the people they are, make these Bonds one of the finest investments in the entire world.

And, for an American, the very finest investment. Why not help your country — and, very importantly, yourself, by buying Bonds regularly? And hold on to them!

It's actually easy to save money—when you buy Series E Savings Bonds through the automatic Payroll Savings Plan where you work! You just sign an application at your pay office; after that your saving is done *for* you. The Bonds you receive will pay you interest at the rate of 3% per year, compounded semiannually, when held to maturity. And *after* maturity they go on earning 10 years *more*. Join the Plan today. Or invest in Bonds regularly where you bank.

Safe as America — U. S. Savings Bonds

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MEMO to Engineers and Contractors . . .

Here are some of the typical advantages Transite Sewer Pipe gives you.

In planning and designing a system

- **high flow capacity** ("n" = 0.010)—permits use of flatter grades or smaller diameter pipe.
- **long life** — corrosion-resistant—durable.
- **tight joints**—cuts infiltration, roots penetration and exfiltration.
- **resilient joints** — absorbs vibration and shock—minimizes effect of earth movement.
- **"all-Transite" line** — Transite Sewer Fittings with Ring-Tite assembly—(plus Transite Building Sewer Pipe).
- **strength** — tough — high crushing strength meets design requirements.

In installing a system

- **light weight**—economical to handle, truck, and lower into trench.
- **long lengths** — easy to line and grade — fewer joints to make — smaller installation crew.
- **packaged joint** — assembly fast, simple, sure . . . even under difficult conditions — no compounds and related equipment.
- **easy-to-assemble fittings** — also with speedy Ring-Tite assembly — no compounds or equipment — all Transite.
- **easily made branch connections, too** — holes for cut-ins quickly done right on job.

Select TRANSITE® for more economical, tighter sewerage systems . . .

Whether a new sewerage system is being planned or additions to an existing one are being made . . . engineer and contractor alike will find a combination of qualities in performance-proved Transite Sewer Pipe that will fit their individual needs. They will find this holds true whether the local conditions call for (a) tight joints to protect against root growth and infiltration of ground water or (b) the strength and flow characteristics that mean definite savings in the design stage, during trenching and installation, and in operation as well.

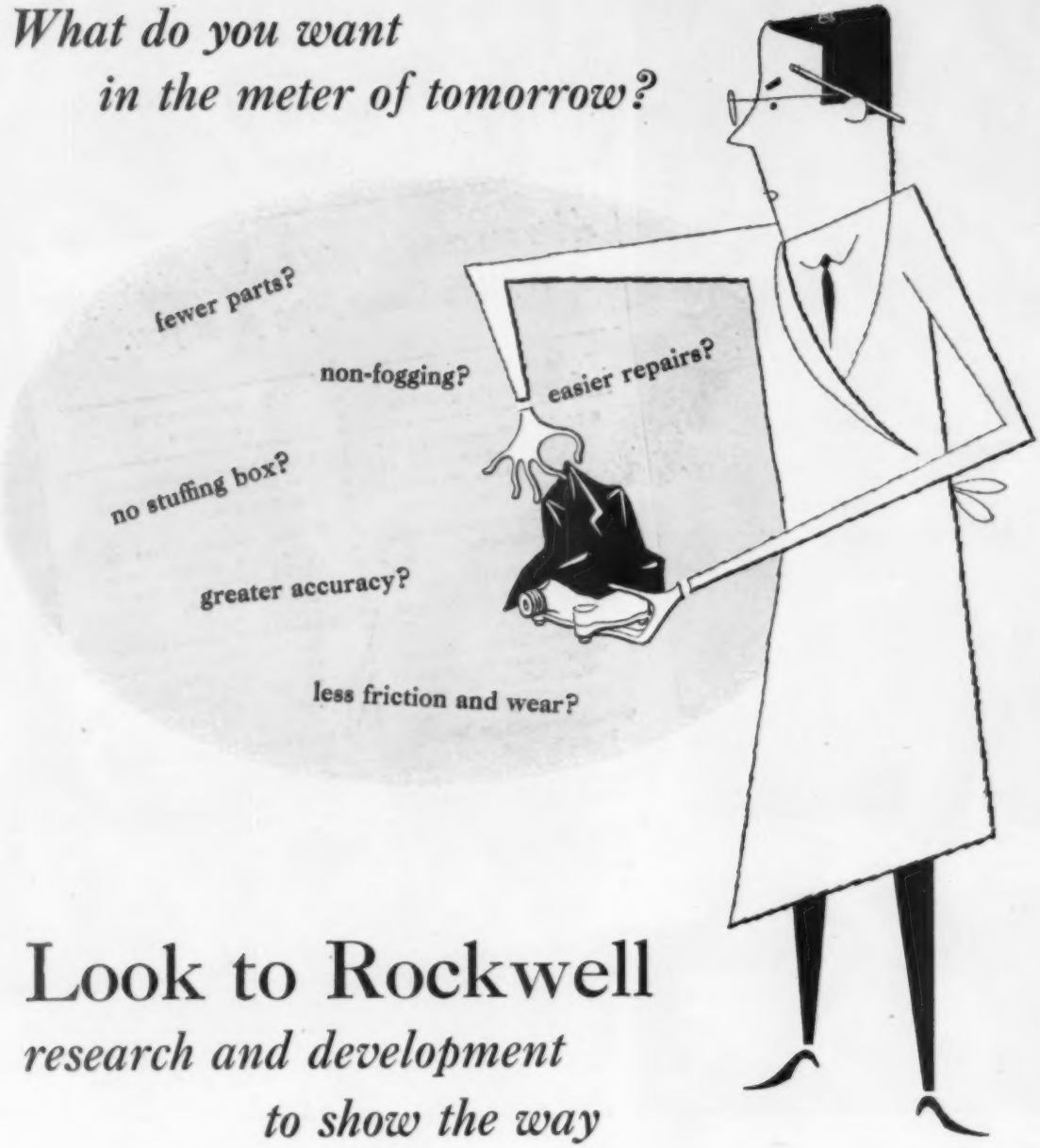
For further information about Transite Sewer Pipe, write for Booklet TR-165A, Johns-Manville, Box 60, New York 16, N.Y.

JM PRODUCTS

Johns-Manville TRANSITE SEWER PIPE

with the RING-TITE® Coupling

What do you want
in the meter of tomorrow?



Look to Rockwell

research and development
to show the way

ROCKWELL

Rockwell Manufacturing Company

Pittsburgh 8, Pennsylvania

CONNECT BRANCH MAINS under pressure . . . FAST!

IOWA

Mechanical Joint Tapping Sleeves and Valves

One Sleeve—One Gasket Fits All Classes of Cast Iron Pipe

No matter whether the pipe in your system is sand cast or centrifugally cast, the Iowa mechanical joint tapping sleeve . . . with one gasket . . . will fit your pipe. The end gasket is reinforced with a strong helical spring molded into the gasket rubber. Always a tight, permanent seal on all classes of cast iron pipe. And, with Iowa Mechanical Joint Tapping Sleeves and Valves, installation is easier, simpler, more economical. You save time, bother, confusion.

Write today for complete information.

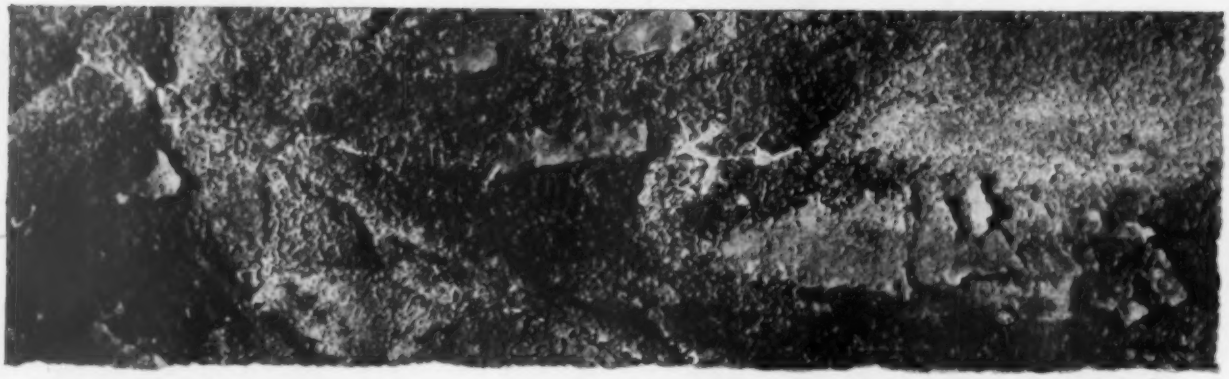
Sleeves and Valves, 3 inches through 12 inches.

IOWA VALVE COMPANY

Oskaloosa, Iowa *A Subsidiary of James B. Clow & Sons, Inc.*

HELPING YOU CUT THE STAGGERING COST OF

CORROSION



IS KOPPERS BUSINESS

Corrosion will cost American industry more than seven *billion* dollars this year! And many more billions of dollars worth of capital equipment will be corroded away in the years to come. To help cut this enormous, and largely needless, waste is an important part of Koppers business.

As the world's leading producer of coal tar base enamels and coatings, we have devoted many years and many man-hours of laboratory research and field work to the problem of *preventing* corrosion. Probably we have within our extensive organization more useful knowledge and experience in corrosion prevention than exists in any other single place. To put that knowledge and experience at your disposal in cutting your corrosion costs, we are initiating a series of informal reports. The first of the series appears at the right.

We hope you'll find these reports on "How to Cut Corrosion Losses" both interesting and helpful. To make them so, we'd like to know about your corrosion problems—especially the unusually difficult ones.

Write: Koppers Company, Inc., 1301 Koppers Building, Dept. 109G, Pittsburgh, Pa. District Offices: Boston, Chicago, Los Angeles, New York, Pittsburgh and Woodward, Ala.

Only Koppers Makes Bitumastic

KOPPERS

BITUMASTIC
REG. U. S. PAT. OFF.
COATINGS AND ENAMELS

how to CUT CORROSION LOSSES

a report by Koppers Company, Inc.

W. E. Kemp,
Manager of the Technical Dept.

Although corrosion losses are never listed on a profit and loss statement, they represent a considerable—and often unnecessary—loss to every industry. Preventing this loss is a big part of our business as the world's leading producer of coal tar base enamels and coatings.

* * *

Many times every week we get a phone call, wire or letter asking the same, often harried, question: "Can you help me with this corrosion problem . . . ?" In most cases, we *can* help, and are most happy to do so. In fact, our Coal Tar Technical Department is designed to facilitate such help.

Basically, we have two groups within the Technical Department—the Development Group and the Technical Service Group. They are both headquartered at Verona, Pa., in a new building with the latest facilities for laboratory work and pilot plant operations. This building also houses the Quality Control staff of the Tar Products Division. These ten chemists cross-check the quality control operations of each plant.

Our Development Group consists of a General Supervisor, Mr. Frank Charlton, and two project leaders who supervise the activities of nine chemists and engineers. They work constantly to up-grade the effectiveness of Bitumastic coatings and to develop new coal tar coatings.

Our Technical Service Group, supervised by Mr. C. U. Pittman, also includes two project leaders and four laboratory workers. These men work in close liaison with our customers, distributors and sales engineers to help them specify the best coating and the most economical application for the job.

We also retain the services of two widely-known coating and corrosion scientists: Dr. W. F. Fair, Jr. and Mr. R. C. Stromquist. Both of these men—and each member of the Technical Department supervisory staff—have had more than 20 years' experience in the bituminous coating field. Dr. Fair and Mr. Stromquist work with all departments and, through first-hand field experience in their extensive travel, alert us to customer needs for new or modified protective coatings.

* * *

Naturally, many of our technical personnel participate quite actively in industrial and technical organizations. One of our coatings consultants, Dr. W. F. Fair, Jr., actually is serving full time this year as president of the National Association of Corrosion Engineers. Altogether, 70% of our men are members of scientific and technical societies. They participate actively on committees working on industry-wide problems.

In future columns, we plan to report to you on specific corrosion problems in such industries as steel, gas, petroleum, water supply and sewage and industrial wastes. In the meantime, we'd like to hear about your problems. Write to Koppers Company, Inc., 1301 Koppers Building, Dept. 109G, Pittsburgh, Pa.

KOPPERS

BITUMASTIC
REG. U. S. PAT. OFF.
COATINGS AND ENAMELS

Installation of these two 5'-high SMS Bascule Gates on a dam 28' in height will enable the City of Decatur, Illinois, to more than double its present water storage capacity, even in dry years. The training wall and concrete pier between the gates is designed to minimize downstream cross-flow and damage to the apron. Harza Engineering Co., Chicago, Illinois, Consulting Engineers.

Individual 29'-long sections of the gate are installed in graphited bronze bearing shoes. A Bascule Gate was chosen over other types here when engineering studies proved it most economical and simplest.

View from downstream side shows final connection of one of the several hydraulic operating cylinders for each gate. Piping on the face of the dam immediately below provides individual isolation of any cylinder.

One of the two 500 psi oil accumulator tanks is about to be raised into position at the control station. Pumps supply pressure to the accumulator tanks for emergency operation in the event of power failure.

New SMS Bascule Gate Design Provides a CLEAR CREST, UNLIMITED LENGTH

Now SMS Bascule Gates can be built to any length you need, and installed without intermediate piers or overhead structures. With this new SMS design, hydraulic operators are located under the gate leaves and controlled from either end. The installation shown above consists of two 233'9" gates. They are the longest ever installed.

An SMS Bascule Gate will increase the storage and spillway capacity of existing dams quickly and economically. It enables you to control heavy run-offs without losing stored water, and to handle regional hazards like ice and heavy debris. In its open position, the gate lies flat on the dam crest and presents no obstruction to flow.

For full information on this new SMS Bascule Gate design—or on hydraulic turbines and other accessories—write to S. Morgan Smith Co., York, Penna.

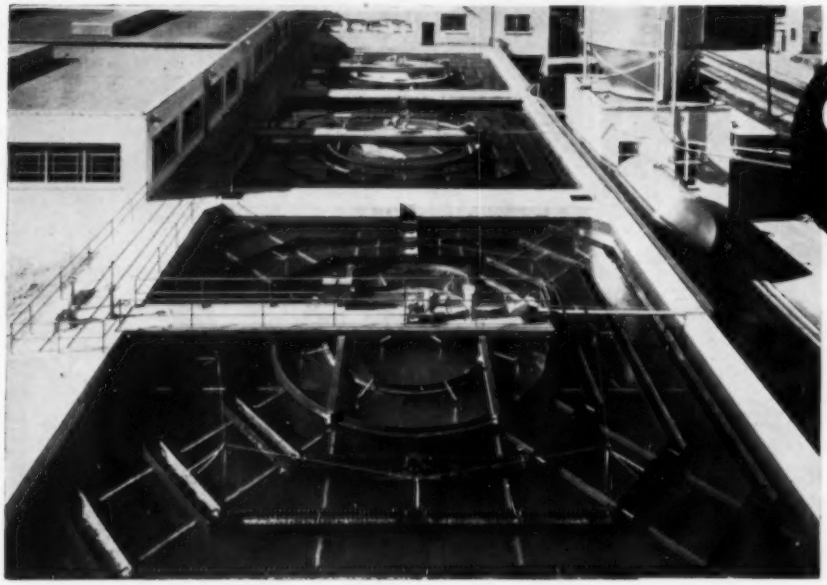
S. MORGAN SMITH

AFFILIATE: S. MORGAN SMITH, CANADA, LIMITED, TORONTO

HYDRAULIC TURBINES
PUMPS
GATES & HOISTS
TRASH RAKES
LIQUID HEATERS
HYDRODYNAMICS
ROTOVALVES
BALL VALVES
BUTTERFLY VALVES
FREE DISCHARGE VALVES
CONTROLLABLE-PITCH SHIP PROPELLERS

WALKER PROCESS Clariflow

Orlando, Florida Water Treatment Plant includes three Walker Process Clariflows for lime softening as well as algae and color removal. The unit in the foreground, completed in 1954, increases the plant capacity to 24 MGD. The two original Clariflows were installed in 1949. Each unit is 56' square x 17' deep.



ORLANDO, FLORIDA

Consulting Engineers—
Robert & Co.,
Atlanta, Ga.
Gen'l. Mgr.—Orlando Utilities Commission—
Mr. C. H. Stanton, Mgr.
Orlando Water Dept.
—Mr. L. L. Garrett

The Clariflow combines flocculation, good fluid mechanics and clarification in a relatively small tank. Mixing, flocculation, stilling and sedimentation are independently operated and controlled. The positive control of flocculation and clarification enables the operator to readily select the most economical method of operation when handling changeable water conditions.

Short circuiting tendencies are eliminated by means of exclusive multiple, tangential diffusers which simultaneously and equally distribute the flow. Balanced multiple surface weir troughs make efficient use of short detention periods and insure clarified overflows.

The Clariflow is applicable wherever there is a municipal or industrial need for water or waste treatment. It can be used in all operations including combined intimate chemical homogenizing flocculation and clarification in rectangular, square or circular basins. The Clariflow gives excellent results in the treatment of municipal and industrial water for—softening—turbidity removal—color removal—algae removal. Industrially it is universally used in—oil separation and emulsion breaking plants—blast furnace flue dust thickening—paper stock reclamation.

Write for bulletin 6W46.

WALKER PROCESS EQUIPMENT INC.
FACTORY—ENGINEERING OFFICES—LABORATORY
AURORA, ILLINOIS

Sewage SLUDGE

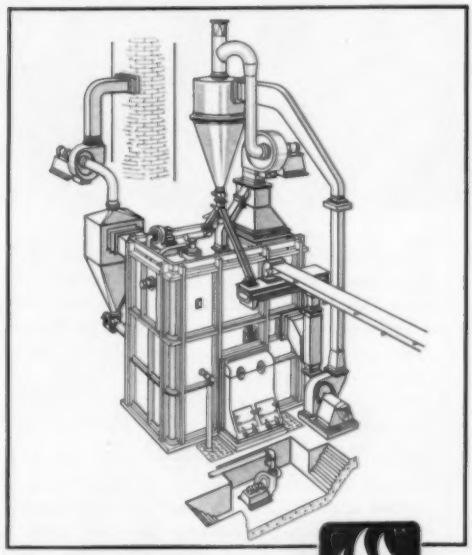
BURN IT!
SELL IT!

You can do both with the C-E Raymond System

For versatility alone, you can't beat the *C-E Raymond System of Flash Drying and Incineration!* With it, you can incinerate sewage sludge to a sterile ash... or flash-dry it to a fertilizer and soil conditioner that is readily marketed. Either operation can be performed alone, or combined in any proportion.

In either case, high-temperature deodorization of stack gases is available.

Whether you wish to incinerate or dry—look to the C-E Raymond System for the effective end to your sludge disposal problems. For specific recommendations for your community, get in touch with a C-E specialist at the office nearest you. He will be happy to work with you and your consultant.



COMBUSTION ENGINEERING

RAYMOND DIVISION

1315 North Branch Street, Chicago 22, Illinois

Eastern Office: 200 Madison Avenue, N. Y. 16, N. Y. *Western Office:* 510 West Sixth Street, Los Angeles 14, Calif.

Canada: Combustion Engineering-Superheater Ltd.

8-930

ALSO FLASH DRYING AND INCINERATION SYSTEMS FOR INDUSTRIAL WASTE DISPOSAL

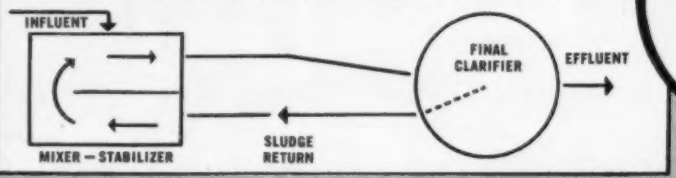
INFILCO *High-Rate* SEWAGE TREATMENT

twice as fast in half the space

Sewage plant of Washington County Sewer Improvement District No. 1, at Bartlesville, Okla., is compact and efficient with INFILCO equipment.

Engineering by Wood & Craig Consulting Engineers, Tulsa, Okla.

FLOW DIAGRAM: DESIGN AVERAGE FLOW 0.39 M.G.D.



Only 5 to 6 hours are required for throughput in the BIOSORPTION® high-rate activated-sludge treatment plant equipped by INFILCO—as compared to 10 to 12 hours for conventional equipment. Main components of the Bartlesville installation include a GRIDUCTOR® comminutor, a mixer-stabilizer with COLAFLEX® diffusers, WS clarifier and floating cover for digester. Overall results are excellent. Here are typical figures.

Period	Ave. Flow MGD	Average B.O.D. (p.p.m.) Raw Sewage	Final Effluent	% Removal	Suspended Solids (p.p.m.) Raw Sewage	Final Effluent	% Removal
1/14-2/3 '55	0.253	197	18	90.8	225	20	91.0

If your problem involves greater volume in less time from less space—*at lower cost*—consult INFILCO because INFILCO KNOWS HOW to help you solve it. Over 60 years of experience and the most complete and advanced line of equipment are available to you. Write today for full information on the interesting Bartlesville installation and Bulletin No. 6550.WS-25.

INFILCO

9685

INFILCO INC.
General Offices
Tucson, Arizona

The ONE company offering equipment for ALL types of water and waste treatment.

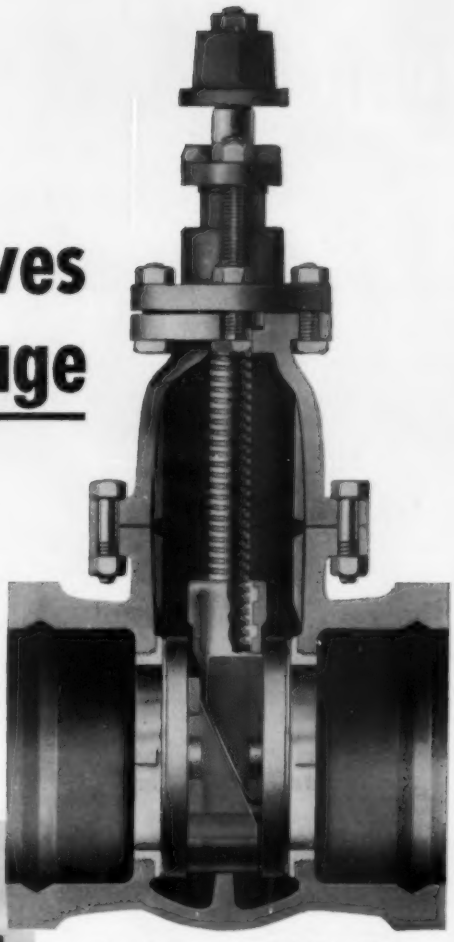
FIELD OFFICES THROUGHOUT THE UNITED STATES AND FOREIGN COUNTRIES

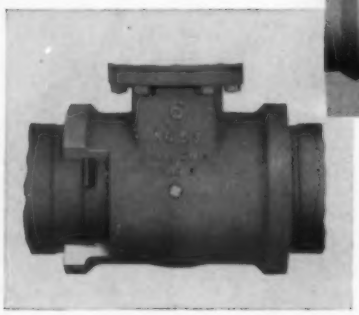
Inquiries are also invited on all other water and waste treating problems including coagulation, precipitation, sedimentation, filtration, flotation, aeration, ion exchange and biological processes.

TRADE DARLING MARK

water works valves offer a 3-star advantage

★ *Outstanding performance*
★ *Long life*
★ *Complete selection*





Above: Cutaway of Darling Water Works Valve showing unique fully revolving double disc parallel seat principle, noted for long life, minimum maintenance and drop-tight closure.

Left: Mechanical Joint and Ring-Tite Joint . . . just two of the various valve ends available on Darling Valves.

DARLING'S topmost quality plus the Darling *fully revolving double disc parallel seat principle*, gives you an unbeatable combination.

The cutaway view shows Darling's simple gate arrangement with its plain no-pocket discs and wedges. These unique features, greatly lengthen disc and seat life, minimize maintenance and assure easy, tight closure and long life.

Conforming to A.W.W.A. specifications and available in sizes for your particular service, these valves are equipped with ends designed to meet your installation needs.

That's what we mean by a 3-star advantage. For detailed facts, send for Bulletin 5403.

DARLING VALVE & MANUFACTURING CO.

Williamsport 11, Pa.

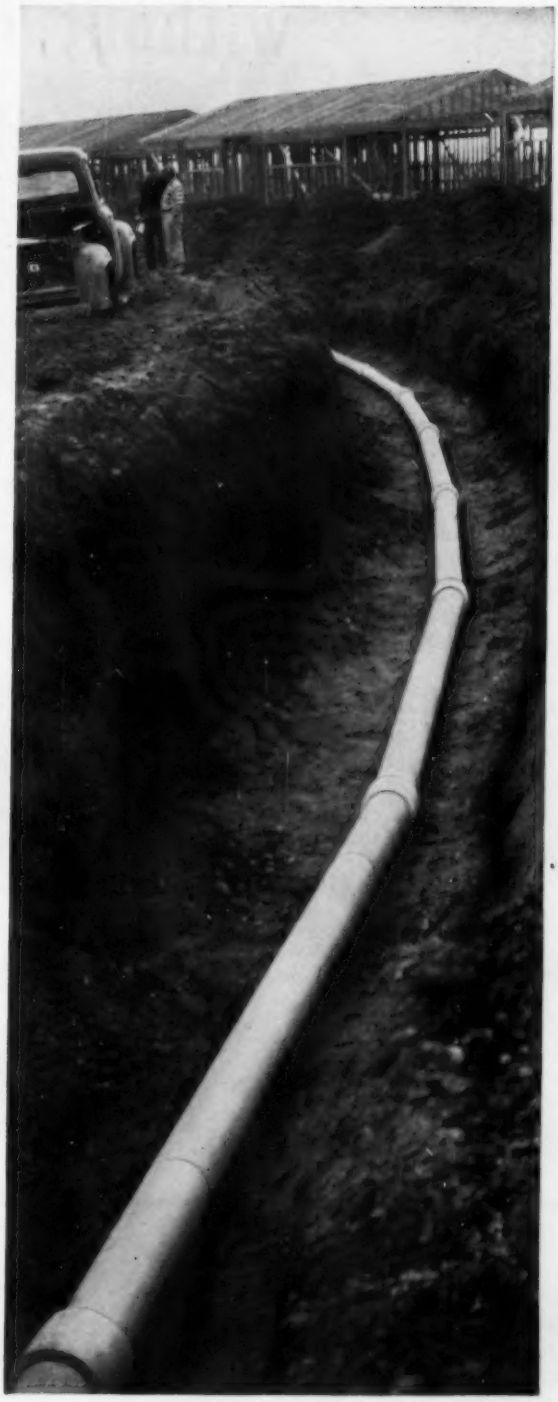
Manufactured in Canada by The Canada Valve & Hydrant Co., Ltd., Brantford 7, Ont.

TAX SAVINGS "AROUND THE BEND"

with K&M "CENTURY"® ASBESTOS-CEMENT PRESSURE PIPE

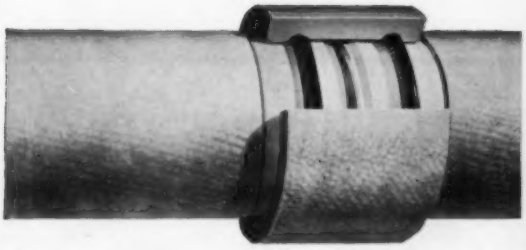
Cutting construction and maintenance costs means tax savings for Madison Park, N.J. And low cost is practically inherent in "Century" Asbestos-Cement Pressure Pipe and "Fluid-Tite" Couplings. The light weight makes for easy, inexpensive transportation and handling, while "Fluid-Tite" Couplings allow quick assembly even with unskilled labor, slashing laying time and cost. Its non-corrosive feature means long underground life. And "Century" Pipe is non-tuberculating and non-electrolytic . . . the bore is always clean and smooth. Pumping pressures remain continuously stable.

Find out how "Century" Pipe and "Fluid-Tite" Couplings can reduce construction and maintenance costs for you. Write today for full details.



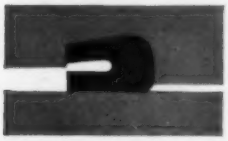
There's no problem in laying K&M "Century" Pipe in a curve. In this Madison Park housing development, "Century" Asbestos-Cement Pressure Pipe with "Fluid-Tite" Couplings allow 5° deflection but fit together easily, requiring no skilled labor for assembly.

and "FLUID-TITE"® COUPLINGS*

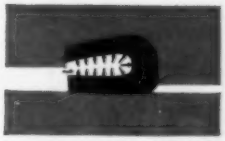


K&M's *exclusive* "Fluid-Tite" Coupling design allows pipe to slide into coupling easily. Water pressure automatically expands the rings.

*Patent applied for



"Fluid-Tite" sealing rings compress, permitting pipe to enter coupling easily.



Water pressure in main expands rings; the higher the pressure, the tighter the seal.

"Century" Pipe and "Fluid-Tite" Couplings meet A.W.W.A., A.S.T.M., and Federal specifications and are approved by Underwriters' Laboratories, Inc.

KEASBEY & MATTISON

COMPANY • AMBLER • PENNSYLVANIA

K&M best in asbestos®

Connect branch mains

without interrupting flow

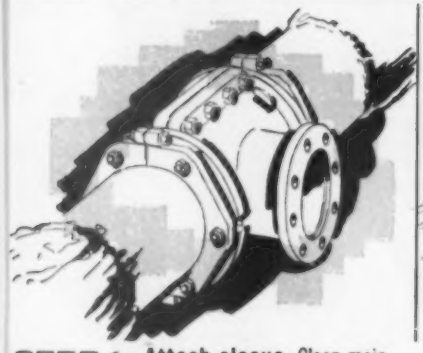
Mueller Tapping Sleeves and Valves or Mueller Tapping Crosses and Valves give you a practical and economical method of running branch mains – without loss of water or interruption of flow in the main.

■ Calked or mechanical joint type are available to suit your individual needs. Extra long length of tapping sleeve or cross plus heavy construction actually strengthens the main where connection is made. Seat opening of tapping valves is larger than nominal size to permit full diameter cuts to be made. A nominal size of mechanical joint tapping sleeve or cross will fit all classes of cast iron pipe regularly used, by using two sets of gaskets.

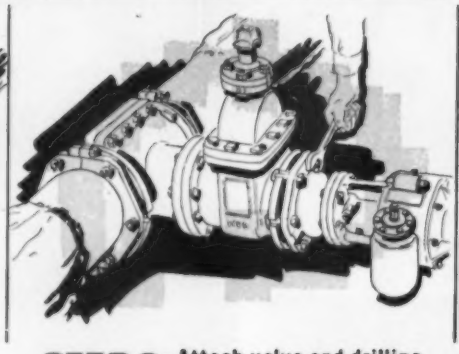
■ Mechanical joint tapping sleeves or crosses, to fit main sizes 4" through 12", offer various combinations of outlets 2" through 12".

■ Calked type tapping sleeves or crosses to fit all classes of pipe 3" through 36" with various combinations of outlets 2" through 16".

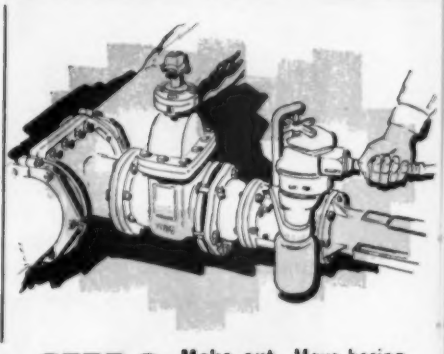
■ Mueller Tapping Valves, calked or mechanical joint type, are available with conventional packing or "O" ring stem seals. Both types have the same time-proven construction as the Mueller AWWA non-rising stem Gate Valve.



STEP 1: Attach sleeve. Clean main of rust and scale. Position and bolt tapping sleeve to main. Tighten mechanical joints or calk and lead sleeve.



STEP 2: Attach valve and drilling machine. Bolt tapping valve to tapping sleeve. Attach hand or power operated drilling machine to valve. Open valve wide.



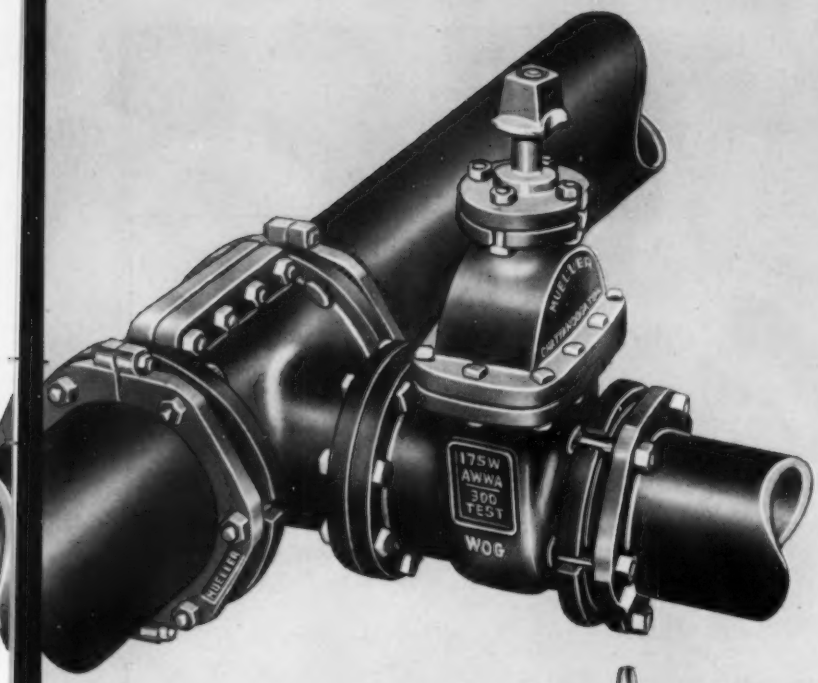
STEP 3: Make cut. Move boring bar forward until it strikes main. Retract two turns–engage automatic feed–make cut. When cut is completed, retract cutter which retains coupon. Close valve–remove drilling machine.

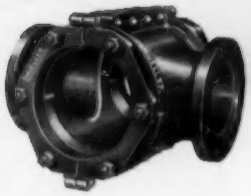
Contact your Mueller Representative or write direct for complete information on Mueller Tapping sleeves and crosses, tapping valves and split repair sleeves.

MUELLER CO.

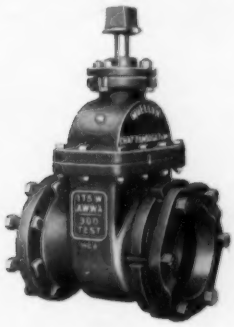
Dependable Since 1857

MAIN OFFICE & FACTORY DECATUR, ILLINOIS

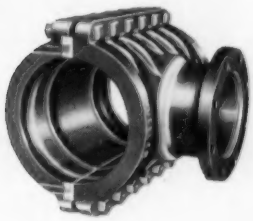




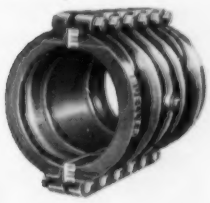
Tapping Cross. Calked or mechanical joint type. Nominal size fits all classes of cast iron pipe.



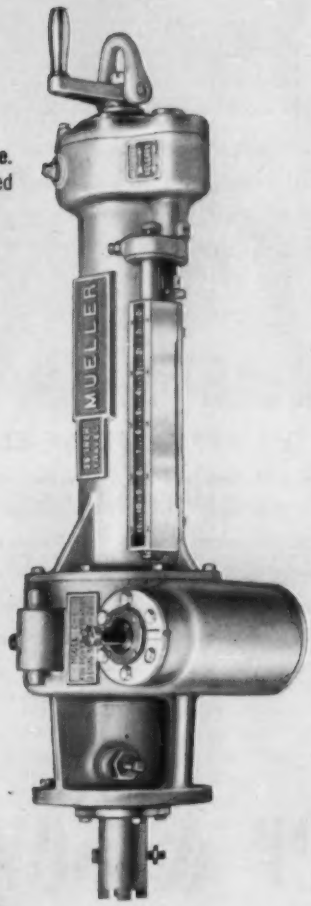
Tapping Valve. Calked or mechanical joint type. Perimeter pressure seating of discs. Conventional packing or "O" ring stem seal.



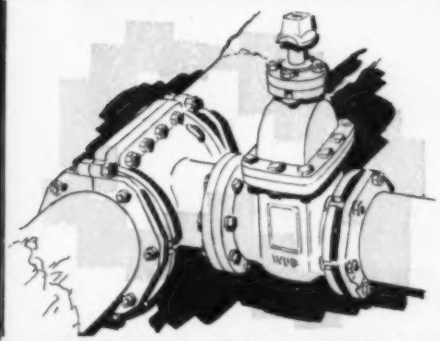
Tapping Sleeve. Calked or mechanical joint type. Nominal size fits all classes of cast iron pipe.



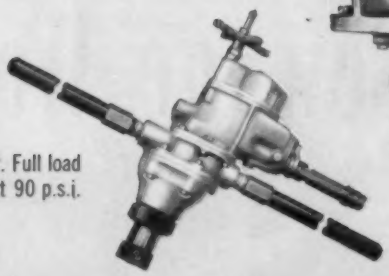
Split Repair Sleeve. Calked or mechanical joint type. One side of sleeve has tapped outlet with plug for escape of fluid while the sleeve is tightened around the leak.



"CC" or "C-1" Drilling Machine. Hand operated or power operated for drilling through the main.



STEP 4: Make connection. Slip branch main into valve and tighten mechanical joint or calk and lead main to valve. Open valve and branch main is activated.



H-600 Air Motor. Full load speed 56 rpm at 90 p.s.i.

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THE INTERESTS OF THE SUBSCRIBER"

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Code of Ethics . . . THE PUBLISHER OF A BUSINESS PAPER SHOULD DEDICATE HIS BEST EFFORTS TO THE CAUSE OF BUSINESS AND SOCIAL SERVICE, AND TO THIS END EACH MEMBER OF THE ASSOCIATED BUSINESS PUBLICATIONS PLEDGES HIMSELF:

Standards of Practice . . . FURTHER, EACH MEMBER OF THE ASSOCIATED BUSINESS PUBLICATIONS SHALL SUBSCRIBE TO AND AGREE TO CONFORM TO THE FOLLOWING STANDARDS OF PRACTICE.

WATER & SEWAGE WORKS is an active member of the Associated Business Publications which this year is celebrating its Golden Anniversary. We take this opportunity to re-affirm our belief in the high publishing principles for which the Association stands and to assure our readers that we will ever "consider, *first*, the interests of the subscriber."

THIS WE BELIEVE . . .

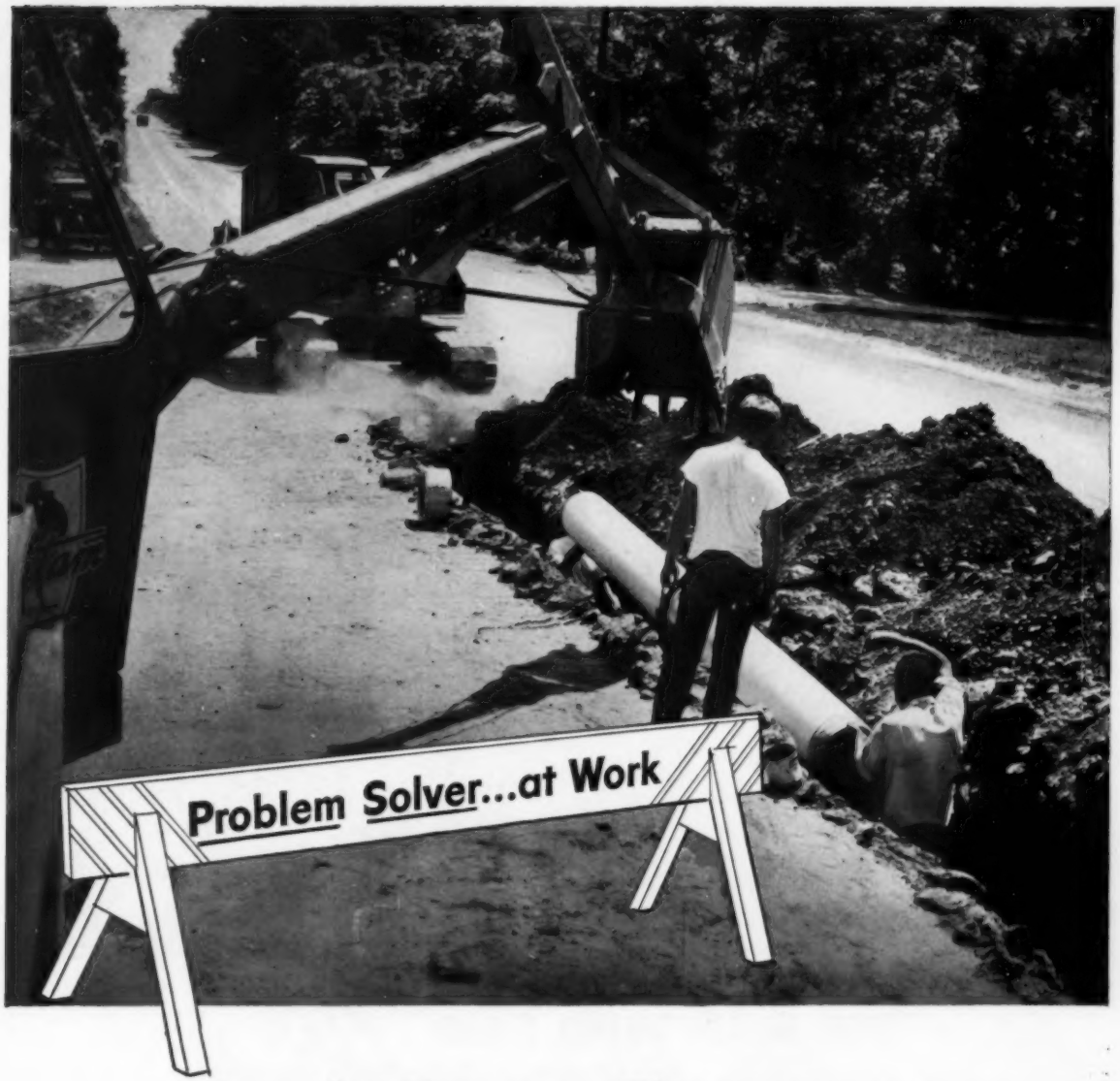
THE ABP CODE OF ETHICS

The publisher of a businesspaper should dedicate his best efforts to the cause of business and social service, and to this end each member of the Associated Business Publications pledges himself:

1. To consider, first, the interests of the subscriber.
2. To subscribe to and work for truth and honesty in all departments.
3. To endeavor to be a leader of thought in his editorial columns, and to make his criticisms constructive.
4. To encourage all constructive efforts to improve the standards and quality of advertising.
5. To avoid unfair competition.
6. To determine what is the highest and largest function of the field which he serves, and then to strive in every legitimate way to promote that function.

ABC / ABP

Water & Sewage Works



Transite Pressure Pipe assures dependable service through the years

ENGINEERS and city officials face much the same problem in pipe selection. It is twofold: (1) How to make sure the community gets many long years of trouble-free performance from its pressure mains, and (2) How to do this as economically as possible by choosing pipe for durability plus savings.

Transite® Pressure Pipe is solving this problem in hundreds of municipalities and water districts from coast to coast. Here's why. An asbestos-cement product, strong and durable and highly resistant to corrosion, it has effected economies in installation as well as operation.

For example, the community benefits even at the very outset, since both handling and assembly of Transite Pressure Pipe are so simple that crews can install as fast as trench is opened. This means lower installed costs.

Another Transite Pipe characteristic instantly recognized by engineers as of major importance is its smooth interior that stays smooth. This provides maintained high flow capacity. (Flow coefficient is C-140.)

* * *

For further information about Transite Pressure Pipe with the Ring-Tite® Coupling, write for Booklet TR-160A. Address Johns-Manville, Box 60, New York 16, N. Y. In Canada, Port Credit, Ontario.

JM PRODUCTS

Johns-Manville TRANSITE PRESSURE PIPE
WITH THE RING-TITE® COUPLING

THE MAN WHO SAID *"No!"*

He's a business man looking for a place to build a new plant . . . a plant that will bring prosperity and growth to the community he chooses. Water supply is one of the most vital questions, and many a golden opportunity has been lost by a community because its water system is inadequate.

In Plattsburgh, N. Y., the story was different. Wasteful habits were causing water shortages, so Plattsburgh decided to install water meters. As a result, they "found" 1,400,000 more gallons daily . . . enough to supply a new Strategic Air Command Base now located there.

Even communities who have had meters for many years . . . but have allowed them to run down . . . can "find" more water simply by repairing the meters.

These savings are *real*. The meters give a strong money incentive for conservation. They help keep wells and reservoirs from running dry. The same filter plants and water mains may serve up to twice as many customers . . . with lower daily operating costs.

Your Neptune Trident meter representative will be glad to offer further evidence.

379

NEPTUNE METER COMPANY
19 West 50th Street • New York 20, N. Y.

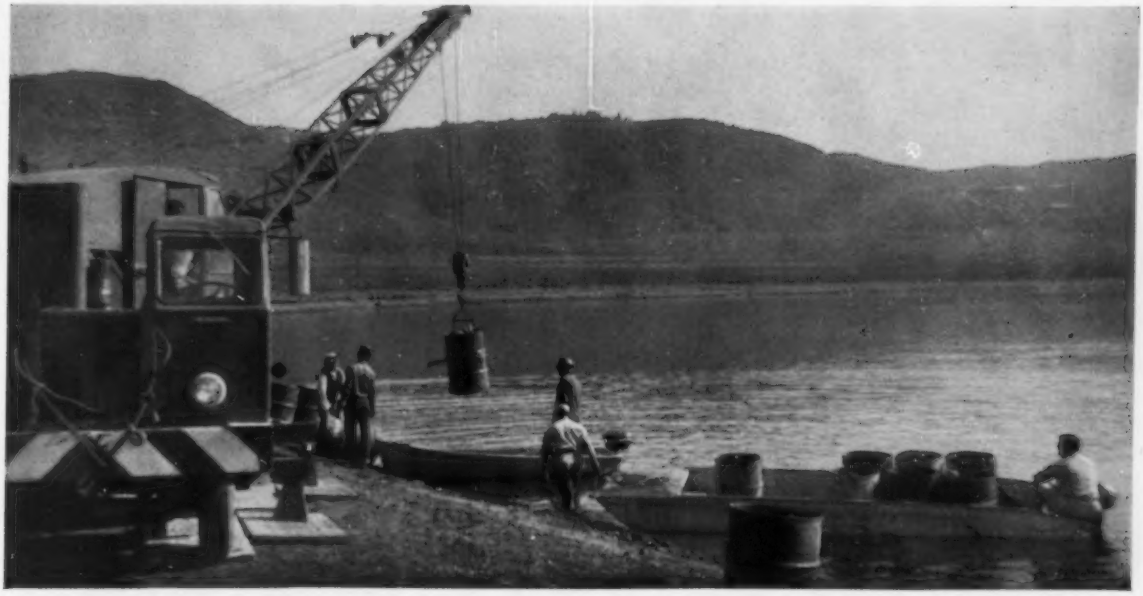
NEPTUNE METERS, LTD.
1430 Lakeshore Road • Toronto 14, Ontario

Branch Offices in Principal American and Canadian Cities.

neptune

WATER & SEWAGE WORKS

VOL. 103, NO. 7 • A Scranton Gillette Publication • JULY, 1956



"OPERATION CARP" nearing completion. Bantam crane transferring barrels of fish from skiffs and boats to trucks.

"Operation Carp" On A San Diego Reservoir

The story of a successful fish-kill project, wherein Rotenone treatment of a reservoir eliminated 174,615 fish to yield 109 tons of fish-flesh for consignment to west-coast processing plants.

WATER FOR THE CITY of San Diego is surface water, collected and stored in eight large impounding reservoirs. These reservoirs impound runoff water from three watersheds: (1) the San Dieguito River System, which includes San Dieguito, Hodges and Sutherland reservoirs; (2) the San Diego River System, which in-

D. A. Hoffman

by DONALD A. HOFFMAN and ROBERT C. PAYETTE

Mr. Hoffman heads the Division of Control and Research in the Water Department of San Diego, California.

Mr. Payette is supervising recreational specialist for the San Diego Water Department.

As far as we are aware, this story is the first of its kind to be published and will prove most helpful to others with a problem of unwanted fish in reservoirs or ponds.

R. C. Payette

GETTING READY for the day's operation of "fish harvesting" Feby 3, 1956—2 barges, 10 skiffs, 20 men, pitchforks and 55 gal. drums a-plenty.

cludes El Capitan and San Vicente reservoirs; and (3) the Cottonwood-Otay System, which includes Morena, Barrett and Lower Otay reservoirs. In addition to the native water provided by runoff, two of these reservoirs received Colorado River water brought in through the San Diego Aqueduct. This aqueduct takes off from the Metropolitan Water District aqueduct at the westerly side of the San Jacinto mountains and travels in a southeasterly direction across San Diego County.

As part of the San Diego Water Department's water quality control program, the above mentioned reservoirs are sampled periodically and examined in respect to biological, bacteriological and chemical quality. Over the past few years the plankton estimations have shown Hodges Reservoir to be consistently very high in both total organism counts and amorphous matter content. This reservoir had total counts during 1955 varying from 9,000 to as high as 18,000 Areal Standard Units. In past years, total counts as high as 116,000 Standard Units have been recorded. This condition was in sharp contrast to the other reservoirs in the impounding system which showed the expected seasonal variations in organism and amorphous matter counts. Hodges Reservoir seemed to be in a continual state of upheaval.

A close and detailed investigation proved that Colorado River water could not be responsible for this turbid condition at Hodges Reservoir since San Vicente Reservoir also received such water, and in considerably greater amounts. Further, the San Vicente Reservoir plankton estimations showed that reservoir to be in excellent condition the whole year around. Samples taken directly from the San Diego Aqueduct showed the Colorado River water itself to be low in total organisms and of a relatively good biological quality.

One Outstanding Difference

Investigation of the reservoirs themselves showed that the only factor present in Hodges Reservoir and not in the other waters was an unusually large Carp population.

This reservoir has long been known as one of the outstanding freshwater sportfishing lakes in Southern California. Angling catch records have been kept since 1929. The average annual take of the various game species was about 97,000 fish or 35 tons per year. The species composition of these fish (by number) was: Bass, 18.5%; Crappie, 58%; Bluegill, 15.7%; and Catfish, 7.8%. In years gone by, there were no restrictions on the kinds of small fishes used as bait. Apparently small Carp were used and many escaped. Thus, the Carp population has steadily increased.

On still days it was not unusual to observe thirty or forty large schools of Carp loafing and playing in the deeper areas of the reservoir. The inlet to Hodges Reservoir from the San Diego Aqueduct takes the form of a channel four feet wide by three feet in depth, approximately two miles long. During the spawning season of 1955 the inflow through this channel was teeming with adult Carp measuring 15 to 20 inches in length.

It was concluded that large numbers of Carp, being a bottom feeding fish, could cause the continuous excessive turbidity noticed in Hodges water, by their constant rooting in the mud of the lake bottom. It would take a lot of them to do this, but after observing the spawning season of 1955, it was concluded that there

CARP GALORE piled up on the shore-line at upper end of reservoir comprised the second lot of fish to remove.

were enough to cause trouble and more to spare.

The City of San Diego has had a contract with commercial fishermen to seine Carp out of Hodges Reservoir since 1946. This means of removing the unwanted fish was very unsatisfactory because the bottom of the reservoir is irregular and full of dead stumps and other debris. Seining, as a long-range solution, was abandoned in 1954, and other methods of elimination of the Carp were investigated.

Planning A Fish-Kill Operation

Tackling such a problem was somewhat difficult, since it was realized that any measure to rid the lake of fish of the Carp family would also destroy the other fish even more readily. However, it was felt that the matter of water quality was so important that something would have to be done, regardless of any or all fish life.

After an extended period of correspondence and gathering together data from various Fish and Game Commissions, State Health Departments, Water Departments and Conservation Departments throughout the country, it was decided to carry out a Carp eradication program at Hodges Reservoir using "Pro-Noxfish"* as the piscicide.

In previous years rotenone has found its largest use as a powdered insecticide. Recently it has been combined with a hydro-carbon dispersive agent and put on the market in the form of an emulsion suitable for use in water. Rotenone is the principal constituent of derris and cubé root, and acts to constrict the blood capillaries supplying the gills of the fish. This causes death by suffocation.

Permission was requested of the State and County Health Departments to carry out an eradication project on Hodges Reservoir aimed at eliminating the *entire fish population*. Application of such a treatment to a large body of potable water met with a considerable amount of reserve, not only from the state and local health departments, but also from our own water quality consultant—Dr. Carl Wilson. This type of thing had never before been attempted in the State of California and, as a consequence, no first hand experience was available as a guide. However, agreement was finally reached and permission was given by the health authorities to go ahead with the program, providing:

(1)-That Hodges Reservoir be held out of service during and after the application;

(2)-That chemical analysis of the Hodges water be made at regular intervals after treatment and before return to service;

(3)-That the reservoir remain out of service until the Rotenone was completely dissipated;

(4)-That we use not more than 2 parts per million (ppm) dosage, a dosage far below the amount determined to have any physiological effect on human beings or other warm blooded animals;

(5)-That the surface of the lake be seined promptly to recover the dead fish, and the fish disposed of as fertilizer or buried in deep trenches away from the water.

These conditions were strictly adhered to throughout the entire project.

Several different utilities use water out of Hodges reservoir; Santa Fe Irrigation District, San Dieguito Ir-

* "Pro-Noxfish" is a commercial product manufactured by S. B. Penick & Co., New York City, and is composed of:

Sulfoxide	2.5%
Rotenone	2.5%
Cube and Derris Root Extractives	5.0%
Inerts	90.0%

BOOM RIGGED landing craft transferring drums containing 400 lbs of fish from pick-up skiffs.

rigation District, Del Mar Utilities, and the City of San Diego. Each of these benefitting agencies was wholeheartedly in favor of the project as a hoped-for improvement in water quality. The people of the County of San Diego also benefitted by the improvement of the fishery. The project was controlled and executed by the City of San Diego Water Department, with these other agencies participating financially with the City in the project costs. The County of San Diego, through the County Fish and Game Commission, contributed 1,210 gallons of the "Pro-Noxfish" chemical emulsions. The California State Department of Fish and Game gave technical assistance where needed and provided a low-draft boat and crew for spraying the shallow portions of the reservoir.

Spraying Procedure

On Tuesday, January 31, 1956, Hodges Reservoir was sprayed with the chemical. The project followed a three-day, 2½" rainstorm. We had been waiting for six weeks for this combination of weather so that the irrigation needs below the reservoir would diminish for two or three weeks, the period of time that the reservoir would be out of service.

A total of 1,375 gallons of the emulsion compound was sprayed onto the surface of the reservoir with two spray boats. The California Department of Fish and Game sprayed the shallow upper portion of the reservoir, about 10 surface acres, with a low-draft aluminum spray boat. The remainder of the reservoir, 178.8 surface acres, was sprayed with a Water Department 36-foot landing craft which is ordinarily used in the application of copper sulphate. The spraying began at 10:00 a.m. in a heavy rain, which soon abated. The weather remained cloudy the rest of the day. The spraying was completed at 4:30 p.m. About one hour was lost throughout the day because of mechanical failures on the pumps, so the entire lake was sprayed in 5½ hours. The temperature of the water near the dam was 58 degrees F. at the surface and 55 degrees F. at the bottom, 50 feet down. The dissolved oxygen was 7 ppm at the surface and 6 ppm at the bottom.

Hodges Reservoir is banana-shaped at the existing water level. It is two miles long and varies in width from 400 to 700 feet. The reservoir was divided into four sections. The volume of water in each section was calculated and a proportionate amount of the chemical was assigned each section. This amounted to one gallon of the emulsion for each 1.68 acre feet of water, or 1.8 ppm of "Pro-Noxfish." This was 3.5 times the manufacturer's recommended dosage for "Rough Fish Control". This increase was deemed necessary in order to insure a *complete* kill.

Previous experience of other users of the chemical indicated that the surface dosage would be dissipated after settling to about the 25 foot depth. Consequently, the lake was sounded and bouys were placed around the "deep" (over 25 feet) area, outlining where it was necessary to add to the surface spray. A flexible sprayer was designed to operate at the 25 foot level and was so arranged that the landing craft could spray at the surface and at the 25 foot depth simultaneously. Unfortunately, the hose leading to the sprayer was caught in the propeller of the boat after about 30 minutes, so the lower spray was abandoned. To compensate for this, the dosage of the surface spray was increased to the full amount for that volume of water. An effort was made to disperse the chemical by creating as much turbulence as possible with the propeller of the craft. The effectiveness of this was proven by the fact that 0.75 ppm of the chemical was detected at the bottom of the reservoir at the deepest point, 50 feet down.

"PRO-NOXFISH" Concentration in ppm.

Sample Depth (Near Dam)	1/31 11:30 AM	1/31 1:30 PM	2/1 11:00 AM	2/1 2:00 PM	2/2 10:00 AM	2/2 4:00 PM	2/3 12:00 Noon	2/10 1:30 PM
Surface (Center of Lake)		1.50	0.75	1.00	0.40	0.20	0.20	0
(Near Shore Line)		3.00		0.75	0.20			
5 feet		1.20	0.75	0.80				
7 feet						0.20	0.10	
14 feet						0.10		
20 feet	0.75	2.10	1.00					
21 feet						0.20	0.10	0
26 feet					0.40			
28 feet						0.10		
40 feet							0.20	
Bottom (50 feet)		0.30	0.50	0.75	0.20	0.20		0

Section by Section Treatment

Each section of the reservoir was treated as a complete unit. First, a barrier of chemical was sprayed across the upper end in an effort to isolate each area. Then the boat sprayed the remainder of the area until the entire surface was covered.

The sprays covered a 40-foot swath with each pass of the boat. The number of trips necessary for each section and the amount of chemical for each trip was calculated in advance.

The spraying procedure was relatively simple. A constant amount of water was discharged through the main pumping system, and the chemical emulsion was then pumped from 55-gallon drums into this discharge at the required amount and when needed. The craft was run at a constant speed throughout the spraying operation so that the only remaining variable was the amount of chemical being applied to a given strip. A 4-cycle gasoline engine driven pump with an adjustable governor was used to pump the chemical. This proved very satisfactory .

Effect on Fish Life

The first fish began floating to the surface about 20 minutes after spraying began. These fish were small three to six-inch Crappie, Bluegill, Catfish and Bass—predominantly small Crappie. About one hour after treatment, large Largemouth Black Bass (4 to 7½ pounds) were floating on the surface. The fish were completely motionless in the water, but very much alive when netted. It was not until two hours after spraying that Carp appeared at the surface. These fish were still gasping for air. When attempts were made to net them, they would dart four or five feet away and then become motionless again. About 80% of the Carp salvaged during the first week were still alive when removed from the water.

By the end of the day following treatment the surface of the lake was dotted with white specks—the Bass, small Crappie, Bluegill and Catfish. Many Carp began to collect along the extreme upper shore line, particularly near the mud flats. That night a great many of the Carp drifted or swam to the mud flats at the upper end of the lake. In the morning of the second day after treatment the shore line was teeming with floundering Carp—see photograph. The fish were piled up ten feet out into the water and along more than half a mile of shore line.

Salvage Operations

On Wednesday, February 1, 24 hours after spraying, the salvage operation began. Twenty men in ten 14-foot skiffs were provided with pitch forks and nets—see photograph. Each boat was equipped with an outboard motor and a 55-gallon drum. While one man operated each skiff, the other would pitch-fork the dead or

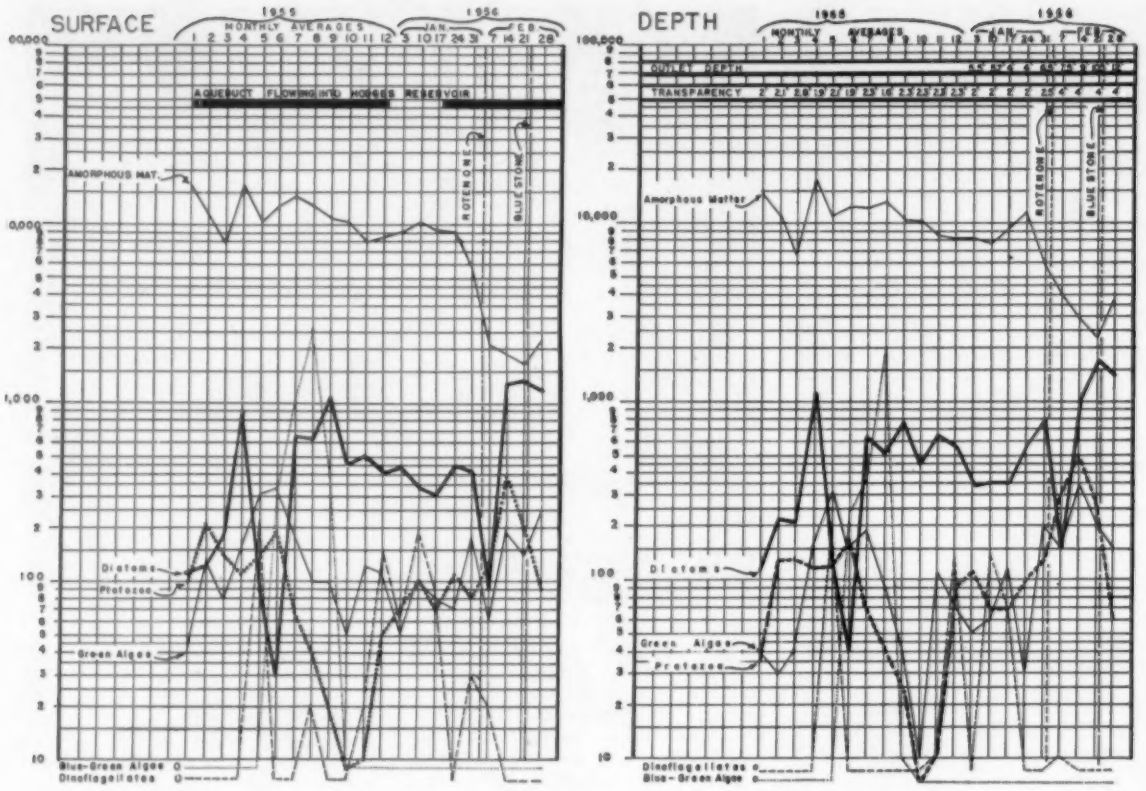
FIRST TO DIE—myriads of small crappies, bass and blue-gills piled up many deep in coves.

dying fish into the drum in each skiff. Two men filled a drum in about one minute. The boat would then be driven a mile down the lake where there was access to the shore line, and a boom truck would pick up the barrel of fish weighing 400 pounds and dump it into a large dump truck —see photograph. The fish were condemned by the County Health Department by spraying with kerosene. The truck hauled the fish to a processing plant in Long Beach where they were processed for chicken feed and fish meal.

By Wednesday night it was quite obvious that the salvage operation would have to be stepped up. We were really in the "fish business"! On Thursday, two large flat-bottomed metal barges were moved in from other reservoirs, each capable of hauling ten full barrels, and the landing craft was equipped with a gasoline powered boom. On Friday morning, a mobile crane with a 30-foot boom (see photograph) was stationed along the shore line and our improved system began functioning. Rather than spending so much time traveling, the skiffs now shuttled from the shore 500 or 600 feet out to the landing craft. There a barrel of fish would be hoisted out of the small boat and placed in a barge. When the barge was loaded, it would shuttle one mile to the mobile crane, where the barrels would then be dumped into a waiting truck. By Saturday night, five days after starting to spray, the lake was completely cleared of all fish and the equipment moved away. A total of 44.8 tons of fish had been removed up to that time.

On Wednesday, February 8, eight days after treatment, it was reported that Hodges Reservoir was "covered with thousands of fish." It was necessary to move all the necessary equipment back to the reservoir and on Saturday, February 11, the harvesting was again in full swing. This second group of fish evidently had sunk to the bottom and after a week's time had become buoyant enough to break the suction of the mud and come to to the surface. A barrel full of 200 fish averaged 280 pounds, as compared with 400 pounds per barrel for the earlier operation. The lake was again cleared of fish by February 13.

During the first operation, 44.8 tons of fish were salvaged. There were 41,820 Carp, 545 Bass, and 39,240 small Crappie, Bluegill, Bass and Catfish. The second harvest resulted in 64.2 tons of fish being collected: 93,000 Carp and 10 Bass. There was a total of 109 tons collected: 106.8 tons of Carp which numbered 134,280; 1.11 tons of Bass which numbered 555; and 1.09 tons of small Crappie, Bluegill, Bass and Catfish, which numbered 39,240 fish. The total number of fish was 174,615. The Carp averaged 16 to 18 inches in length and 2 pounds, alive; the Bass averaged 20 inches in length and 4½ pounds, alive; and the small Crappie, Bluegill and Bass averaged 18 fish per pound and were two to five inches in length. One large Bullhead Catfish, 24 inches in length and weighing 16 pounds was recovered—see photograph.



EFFECTS on organisms in the Hodges water, resulting from "Pro-Noxfish" treatment and later by copper sulphate treatment—Chart I (left); Chart II (right).

Hodges Reservoir will be restocked with brood fish as soon as the rotenone has dissipated. An estimated 2,560 Channel Catfish, six to nine inches in length, were planted on February 28, 1956, by the California Department of Fish and Game. About 250 adult Largemouth Black Bass, two pounds or better, 1000 adult Bluegill, and 125 adult Crappie will be planted by late March, in time for this year's spawn.

On the basis of laboratory analyses and with the consent of the State Health Department, delivery of water from Hodges Reservoir was resumed on February 29, 1956.

Laboratory Control

For control and study of this treatment a field laboratory was set up at the reservoir. Personnel from both the State Health Department and the San Diego Water Department were present, and they carried out quite extensive and frequent samplings and analyses.

The analytical procedure used was the one for Rotenone given in the Merck Index but modified slightly. It is as follows:

(1) Extract a 500 ml. water sample with 10ml. of chloroform.

(2) Treat extract with 1 ml. of a 10% Thymol solution in chloroform.

(3) Add 1 ml. of a mixed acid reagent prepared by mixing 100 ml. of concentrated HCL and 0.2 ml. concentrated HNO_3.

(4) Shake for one minute.

(5) Allow to stand *in the dark* for 30 minutes and then compare colorimetrically with standard solutions of "Pro-Noxfish" treated in the same manner.

The color developed is a pale blue-green, more green than blue. It was found that this method, although far from perfect, did, with proper manipulation and precautions, give fairly consistent and reasonably accurate results. It is important that the samples and standards be exposed as little as possible to air and sunlight during the determination. Rotenone undergoes decomposition in the presence of air or sunlight.

In sampling and analysis, the main emphasis was placed on the quality of the water at the dam near the reservoir outlet. In all, some 64 samples were taken and analyzed by the Water Department personnel alone. Of these 64 samples, 31 were at the dam, near the reservoir outlet.

Laboratory results showed that two days after treatment the highest residual of "Pro-Noxfish" was but 0.2 ppm. In less than 10 days after treatment no "Pro-Noxfish" could be detected in the samples taken at the surface, the 21 foot depth or the bottom of the reservoir. Results obtained by the Water Department laboratory personnel are given in the accompanying table.

The biological reaction of Hodges Reservoir to the "Pro-Noxfish" treatment was quite comparable to that which would be expected from a properly applied copper sulphate treatment. Amorphous matter and all organism counts decreased quite markedly except for Protozoa at the surface and Protozoa and Dinoflagellates at the depth. Water clarity increased and the lake began to lose its muddy, murky look.

Subsequent to treatment with "Pro-Noxfish," it was observed that a diatom pulse was developing. The lake was immediately bluestoned. Charts I and II show the organism and amorphous matter concentrations before and after the "Pro-Noxfish" and the bluestone treatments.

Organism concentrations during 1955 have been plotted as monthly

averages of the samples taken and examined. Concentrations plotted for January 3, 1956, and after, represent counts from individual samples.

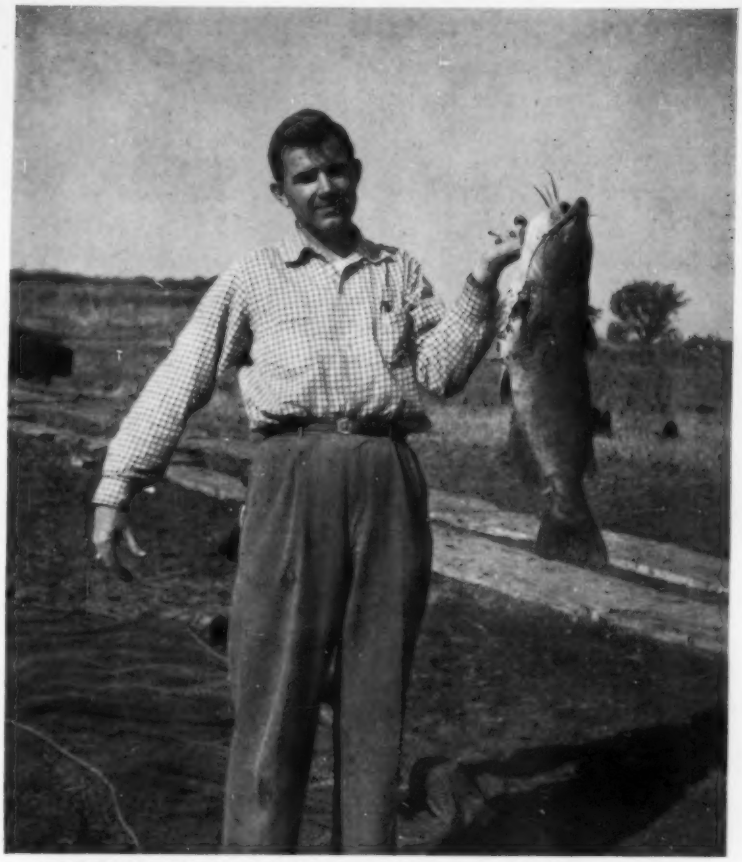
Samples taken after "Pro-Noxfish" treatment had a faint odor, best described as a mixture of oily, earthy and aromatic. This was attributed to the hydrocarbon dispersive agent used in the formulation of the "Pro-Noxfish." This odor tapered off in intensity until it was practically undetectable in the sample taken on February 28, 1956.

Acknowledgements:

We would like to express our appreciation for the cooperation and assistance which each of the following people and organizations gave in helping to make the operation possible: the Boards of Directors of the Santa Fe and San Dieguito Irrigation Districts and of the Del Mar Utilities Corporation; Dr. J. B. Askew, Director of Public Health, County of San Diego; Arthur W. Reinhardt, District Engineer, State Department of Public Health; Dr. Carl Wilson, water quality consultant for the City of San Diego Water Department; the San Diego County Board of Supervisors; Dr. J. Manor Howard, Secretary, and the members of the San Diego County Fish and Game Commission; Harley Knox, President, State of California Fish and Game Commission; John Janssen, Manager, Region 5, and his staff, State Department of Fish and Game, Los Angeles; Dr. Ronald Crawford, Merrel Taylor and Andrew Olson of the Life Sciences Department of San Diego State College; and personnel of both Production Division and the Control and Research Division of the San Diego Water Department.

We would also like to express our appreciation to the following men and organizations for information and reports; Richard G. Stroud, Executive Vice-President, Sport Fishing Institute, Washington, D. C.; William A. Tompkins, Chief Aquatic Biologist, Department of Conservation, Division Fisheries and Game, Upton, Massachusetts; P. A. Douglas, Associate Fisheries Biologist, California State Department of Fish and Game, Los Angeles; Jack Hemphill, Chief of Fisheries, Arizona Game and Fish Department, Phoenix, Arizona; John H. King, Chief, Fisheries Division, Oklahoma Game and Fish Department, Oklahoma City, Oklahoma; and James C. Simpson, Chief, Fisheries Division, State of Idaho, Department of Fish and Game, Boise, Idaho.

The project was carried out with the active interest and support of Mr. Paul Beermann, Director, San Diego Water Department, while under the general supervision of Roy E. Dodson, Superintendent of the Production Division, San Diego Water Department.



PROOF of the effectiveness of "Operation Carp"—only this one is a 16 lb. 24 in. "Cat" held for cameraman by one of the authors—R. C. Payette

Chemical Industry Opposing Further Increase in Federal Pollution Control

Pollution abatement in the United States by industry is improving rather than getting worse. Primary responsibility for water pollution control should be left at the state or regional level. As much was pointed out by a chemical industry spokesman before the House Public Works Committee at hearings on proposed legislation—H.R. 9540.

In opposing further increase in federal control, Harold L. Jacobs, chairman of the water pollution abatement committee of the Manufacturing Chemists' Association, said "the need for additional federal powers has not been demonstrated," and that a continuation of the existing federal law (P.L. 845) would assure continued improvement in the water pollution situation. He pointed to the progress which has been made by the Ohio River Valley Water Sanitation Commission, an eight-state compact, and the New England Water Pollution Control Commission as illustrations that state-level and regional-level control is proving satisfactory.

Showing industry's awareness of its responsibility, it was pointed out that the chemical industry alone is spending 25 to 40 million dollars each year on pollution abatement facilities, not including operating costs. Today pollution abatement facilities for new plants are "included in plans from the drawing board up."

The Mfgrs. Chemists Assn. has suggested amendments to define more clearly in H.R. 9540 the basis for the entry of the federal government into the enforcement picture, so as to minimize displacement of state enforcement authority.

Photo Courtesy St. Louis Chamber of Commerce

ST. LOUIS KIEL AUDITORIUM where technical sessions of the convention were held and equipment exhibits staged.

AWWA Diamond Jubilee

76th meeting a huge success in St. Louis

ON MAY 6TH-10, 1956, the American Water Works Assn. met in St. Louis, Mo. This was the sixth time the Association had met there, but this time it was different; this time it was special. This meeting was in celebration of the Diamond Jubilee Anniversary of the founding and first meeting, held in St. Louis in 1881. (For the record, other meetings in St. Louis were in 1904, 1918, 1930 and 1946).

The 76th meeting didn't quite top the all-time attendance record (2,587) in Chicago last year but the 2,538 persons who did attend gave evidence that AWWA meetings in the future are likely to break the record again and again.

The following tabulation shows the registration breakdown for the last three meetings.

	1954	1955	1956
Water Works Personnel, etc.	901	1167	1154
Equip. Mfr. Repr.	635	908	874
Ladies	527	512	510
Total	2063	2587	2538

Exhibits

Although the registration lacked 49 of equalling the record in Chicago last year, the number of manufacturers exhibiting as well as the number of booths occupied did break the Chicago record. This tabulation shows a very healthy trend.

	1954 Seattle	1955 Chicago	1956 St. Louis
No. of exhibitors	90	93	100
No. of booths	150	167	182

If this trend continues both as to registration and exhibitors, then the number of cities where the AWWA can successfully hold meetings begins to narrow to a few.

Not only were there more booths in St. Louis but they seemed to receive more visitors and more attention than at previous meetings. Considering the fact that the exhibit hall was below and some distance from the meeting rooms, the good "play" which the booths received was a tribute to the exhibitors and their displays. As has been customary for some years the Water & Sewage Works Manufacturers' Assn. played host on the exhibit floor by dispensing 4669 cups of Coca Cola, just 24 short of the record 4693 served in Chicago.

Sessions & Social Events

Sixteen technical sessions were held beginning Monday morning and ending Thursday afternoon. These sessions covered water works management and administration, water purification, water resources, water works practice, water distribution and water works history.

Eighteen AWWA committees met during the week and eight breakfasts or luncheons were scheduled for such diverse groups as the Executive and General Policy Committee, Division Officers, Section Secretaries, Fuller Award Society and the Manufacturers Assn.

The Social Calendar included "The Birthday Buffet" on Sunday evening; Awards Night and President's Reception on Monday night; Golf Tournament, on Tuesday; a Rodgers and Hammerstein Festival on Tuesday night; "On-your-own night, Wednesday; and the Anniversary Banquet and Ball on Thursday night.

Awards night on Monday was enhanced by an operetta group from the Washington University Fine Arts School. Menotti's opera, *The Telephone* and duets from *The King and I* were presented.

Most outstanding entertainment event of this convention, and one that will be hard to top, was the Rodgers and Hammerstein Festival. Four accomplished soloists, a chorus from the St. Louis Municipal Opera and an orchestra drawn from the St. Louis Symphony combined to present an evening of excerpts from the Rodgers and Hammerstein hits, *Oklahoma, South Pacific, Carousel* and *Pipe Dream*. This was a night of entertainment which will not be forgotten.

On the off night, the Cardinal-Phillies baseball game drew a large number of water works people; and as always, individual manufacturers provided entertainment rooms where one could drop in for a drink or a chat whenever there wasn't anything else going on.

For the ladies, there was a Rendezvous where facilities were available for meeting, cards, chatting or relaxing. In addition to the festivities previously mentioned, the ladies had a special bus tour including a riverfront excursion, Busch Farm, and Shaws Garden which features an outstanding horticultural exhibit. Enroute, a box luncheon was served.

On Tuesday afternoon for those ladies not playing golf, there was a card party-tea with both bridge and scrabble games. Wednesday provided special auto trips (with 50 private automobiles) touring the Art Museum, Jefferson Memorial, Lindbergh exhibits, Washington University and several parks.

Thursday afternoon was set aside for a Luncheon-Fashion Show at the Starlight Roof of the Chase Hotel. A souvenir plate of the AWWA 75th anniversary was given to the ladies.

Inspection trips were scheduled and held for the St. Louis County Water Co. North County Plant; the St. Louis Water Dept.; the Keasby & Mattison Co. Asbestos-Cement Pipe Plant; and the Mississippi Lime Co. Plant.

Anniversary Banquet

Annual banquets come and go, but this one was something special for it was in celebration of 75 years of existence and growth. A testimonial to that growth was depicted in the bargraph chart which appeared on the front cover of the May issue of *Water & Sewage Works*.

Of particular interest this year was the special salute to 34 associate members, with certificates of honor being presented to management representatives of those companies. Col. Willard F. Rockwell, Board Chairman, Rockwell Mfg. Co. made the acceptance speech for the whole group of manufacturers. The following list shows those "Senior Associate Members of AWWA" and the year they joined the association.

1882 Bingham & Taylor Corp.
1882 Hays Manufacturing Co.
1882 The Ludlow Valve Manufacturing Co., Inc.
1882 Mueller Co.
1882 National Meter Division of Rockwell Manufacturing Co.
1884 The Bourbon Copper & Brass Works Co.
1884 The Chapman Valve Manufacturing Co.
1884 R. D. Wood Co.
1884 Worthington Corp.
1885 James B. Clow & Sons, Inc.
1885 National Tube Division, United States Steel Corp.
1885 Eddy Valve Co. of James B. Clow & Sons, Inc.
1887 Hersey Manufacturing Co.
1890 Rensselaer Valve Co. Div. of the Ludlow Valve Manufacturing Co.
1891 The Thomson Meter Corp.
1892 The Farnan Brass Works Co.
1892 U.S. Pipe & Foundry Co.
1894 Neptune Meter Co.
1897 The A.P. Smith Manufacturing Co.
1898 Pittsburgh Equitable Meter Co. Div., Rockwell Manufacturing Co.
1898 Lead Lined Iron Pipe Co.
1901 B-I-F Industries, Inc.
1902 General Chemical Div., Allied Chemical & Dye Corp.
1903 The Central Foundry Co.
1904 Badger Meter Manufacturing Co.
1904 Dresser Manufacturing Div., Dresser Industries, Inc.
1905 Allis-Chalmers Manufacturing Co.
1905 Buffalo Meter Co.
1906 American Cyanamid Co.
1906 National Water Main Cleaning Co.
1906 The Pitometer Associates, Inc.
1907 American Cast Iron Pipe Co.
1907 Glamorgan Pipe & Foundry Co.

Association Officers—1956-57

Outgoing President	Incoming President	Vice President	Treasurer
Frank C. Amsbary Vice Pres. & Gen. Mgr. Long Island Wat. Co. Lynbrook, L.I.	Paul Weir Gen. Mgr. Water Works Atlanta, Ga.	Fred Merryfield Prof. San. Eng. Ore. State Coll. Corvallis, Ore.	W. W. Brush Editor Wat. Wks. Eng. New York, N.Y.

At the banquet ceremonies presentations were made of the Hill and Henshaw Cups and the Old Oaken Bucket. The *Nicholas S. Hill, Jr. Cup* went to the Southwest Section for the best gain in membership (Indiana and California were runners-up).

The *Franklin Henshaw Cup* went to the Cuban Section for having present at its annual meeting, the highest ratio of members to non-members.

The *Old Oaken Bucket*, symbol of the largest section in the association again went to California which now holds a lead of less than 300 over the Southwest Section.

As is customary, the changing of the presidents took place at the banquet. Frank C. Amsbary, Jr. was presented a suitably inscribed desk pen set and turned the chores and responsibilities over to Paul Weir, Gen. Mgr. Atlanta, (Ga.) Water Works.

In his inaugural address, Mr. Weir emphasized that "progress is our challenge". The association has need for more members and those members

Honorary Members

A. P. Black Head Dept. Chem. Univ. of Fla. Gainesville, Fla.	H. F. Cronin Ch. Engr. Met. Wat. Bd. London, England	Thos. J. Skinker Comr. Water Dept. St. Louis, Mo.	W. Victor Weir Pres. St. Louis County Water Co. St. Louis, Mo.

W. J. Orchard
Director
Wallace & Tiernan
Newark, N.J.
(Jordan Achievment Award)

F. G. Gordon
Asst. Ch. Engr.
Bur. of Engr.
Chicago, Ill.
(Diven Medal)

Leslie Paul
Supv. Engr.
E. Bay Mun. Dist.
Oakland, Calif.
(Distribution Div. Award)

Abel Wolman
Prof. San. Eng.
Johns-Hopkins Univ.
Balto, Md.
(Management Div. Award)

M. R. Lindorf
Student
Univ. of Calif.
Berkeley, Calif.
(Jordan Scholarship Award)

Awardees

(Other awardees, whose photos were not available, are listed in the text)

both present and future are deserving of higher salaries for the services rendered.

Mr. Weir also spoke of the future; he foresees the increased use of automation, the use of solar energy, the use of the electric analyzer in more cities and increased application of sewer service charges based on water consumption.

One of the highlights of the banquet and of award night was the presentation of Dr. Edward Bartow, one of the three oldest living past presidents of AWWA. Dr. Bartow has been Editor of the Journal, and it was he who initiated the idea of sections. He was President of AWWA in 1922.—Beekman C. Little (Pres. in 1921) and Carleton E. Davis (1920) are still living but did not attend the meeting in St. Louis.

Secretary
Harry E. Jordan

Exec. Asst. Secy.
Raymond J. Faust

Asst. Secy.
Eric Johnson

Association Secretaries

75 Years of AWWA

One general session was devoted to a review of the past 75 years. In addition to the three scheduled speakers, this session featured the presentation of slides of all 76 presidents of the Association and the reading of letters and telegrams of congratulations.

Outstanding among these messages was a telegram from the President of the United States to Frank C. Amsbary, AWWA President. It read:

"Please extend my warm greetings to all attending the convention celebrating the seventy-fifth anniversary of the American Water Works Assn.

"Increasing population and the development of new home and industrial areas present new opportunities to those in your field by disseminating information on improved methods and products. This meeting, I am certain, will assist all of you in your efforts to meet such opportunities efficiently. In these efforts all of you have my best wishes for success.—Dwight D. Eisenhower."

Among the many other organizations sending best wishes and congratulations were:

Engineers Joint Council
American Public Health Assn.
Assn. for the Development of Water Resources in Netherlands
Inst. of Dutch Water Works
British Water Works Assn.
Inst. of Water Engineers
Amer. Soc. Civ. Engr.

In acknowledgement of the fact that the first meeting was held in Engineers Hall at Washington University in 1881, President Amsbary introduced W. Victor Weir (AWWA Past Pres. and current president of the Washington University Alumni Assn.) Mr. Weir in turn introduced Dr. Alexander S. Lansdorf, Dean Emeritus of Engineering of Washington Univ. Dean Lansdorf reminisced about the water supply of St. Louis (the first clean water in 1903) and thus set the scene for the historical talks to follow.

Program
Richard Hazen
Partner
Hazen & Sawyer
New York City

Transportation
L. F. Frazza
Johns-Manville
New York
City

Local Host
V. C. Lischer
Cons. Engr.
St. Louis
Mo.

Local Committee
H. O. Hartung
Supt. Prod.
St. L. County Wat. Co.
St. Louis, Mo.

Committee Chairmen

Wolman On Water Quality

Dr. Abel Wolman, Prof. of San. Engr. at Johns Hopkins Univ. in Baltimore and a past president of AWWA spoke on "Seventy-five years' Improvement in Water Supply Quality".

Dr. Wolman reviewed the subject in terms of personalities, pointing out that while progress in water supply quality was more than 75 years old, it was the AWWA which had stimulated our greatest progress.

Contrasting 1850, when only 68 cities had water supplies, with 1956 when there are 18,000 urban supplies, Dr. Wolman commented on the change in water treatment methods from slow sand filtration to rapid sand filters with coagulation and disinfection and he emphasized that all changes had resulted in improved public health.

In respect to personalities and the parts they played in water works progress, Dr. Wolman mentioned Kirkwood, Hyatt, Hazen, Johnson, Hansen (filtration); Dr. Wm. T. Sedgwick and Theobald Smith (laboratory analysis); Phelps, Ellms, Enslow (chlorination); Whipple, Baylis Spaulding, and Tamer (taste and odor control); Fuller, Weston, etc. (coagulation) and many others.

Dr. Wolman also commented on the attitude of early water works managers and the progress toward sound public relations, on the importance of standard methods of analysis as a common language, and on the need for international standard methods (first suggested in 1926 by George W. Fuller and now receiving consideration by a WHO committee chairmaned by F. W. Gilcreas).

In conclusion, Dr. Wolman paid tribute to the manufacturers of commercial equipment and the significance and impact of their products. Most studies in the early days went ahead in spite of patent contests but today manufacturers' development engineers are working with operators toward the tailoring of water to its specific use. In spite of 75 years of progress we are still in the threshold of a new era.

Chase on Engineering Progress

E. Sherman Chase, Partner, Metcalf and Eddy, Consulting Engineers, Boston, reviewed "Seventy-five years of Progress in Water Supply Engineering."

"The history of mankind is that of being pushed or pulled by superior intellects" was the quotation with which Mr. Chase opened his paper. He was referring, of course, in particular to the improvements in water supply practice as evidenced by improvements in engineering practice.

Water & Sewage Works Manufacturers Assn.

President	Vice President*	Vice Pres. Elect	Treasurer
J. A. Frank Vice Pres. Nat. Wat. Main. Clean. Co. Hackensack, N.J.	H. E. Schlenz Pres. Pac. Flush Tank Co. Chicago, Ill. (*Pres. Elect)	Rich. Ford Vice-Pres. Ford Meter Box Co. Phila. Pa.	H. F. O'Brien Pres. A. P. Smith Co. E. Orange, N.J.

In 1881 there were 593 water supplies of which 293 were public and 300 were private; in 1956 there are 18,000 supplies of which 12,600 are public and 5400 are private. During this 75 year spread there have been many changes besides numbers.

The first book on water supply was published in 1877, now there are masses of publications, books, magazines, journals, etc. There has been no change in source of supply; ground waters and surface waters still serve as sources, but now there are larger dams and reservoirs on streams and well systems are highly developed. Today we talk of and study sewage reclamation for ground water recharge and we use seismic observations in searching for ground waters and we are studying sea water reclamation.

The greatest change in water works engineering has been in methods of pumping, from the steam pumping engine to centrifugal pumps, first powered by steam turbines now by electric motors with gas and diesel engines for standby power.

Changes in distribution system engineering have seen the installation of larger and larger mains, and the acceptance of asbestos-cement pipe and cement pipe for pressure lines in competition with cast iron and steel pipe. Linings of pipe have undergone changes and improvements and are still under development. New standards for pipe keep abreast of the times.

Elevated storage (the first elevated tank was built in St. Louis in 1889) has changed from steel stand pipes to attractive and well engineered storage tanks in both steel and pre-stressed concrete. Customer service lines once were lead, now are generally copper, but plastic pipe is also being used.

Metering of main line flows was introduced in 1887 with the invention of the Venturi tube by Clemens Herschel. Main line metering is generally practiced today using a variety of flow measuring devices. Metering of customers services has grown by leaps and bounds but 100 per cent metering of systems is not yet universal.

For the future one may expect increased automation, new equipment, and higher standards of engineering and operation.

Murdoch on Too-Cheap Water

Speaking as a water works man, and not as Vice President and Coun-

Standing Comm. Chairmen

W. W. Practice	W. W. Admin.
L. R. Howson Cons. Engr. Chicago, Ill.	W. R. LaDue Gen. Mgr. Wat. & Sew. Dept. Akron, Ohio

Division Chairmen

Purification	Distribution
H. H. Gerstein Asst. Ch. Engr. Bur. of Wat. Chicago, Ill.	H. W. Niemeyer Supt. Dist. Ind. Wat. Co. Indianapolis

Programmers

Engineering	Rates
E. S. Chase Cons. Engr. Metcalf & Eddy Boston, Mass.	John Murdoch, Jr. Vice Pres. Am. Wat. Wks. Service Co. Philadelphia, Pa.

sel of the Amer. Water Works Service Co., John H. Murdock, Jr. made a stirring condemnation of the low water rates which prevail in this country. His topic was "Seventy-five Years of Too-Cheap Water."

"Too-cheap water" is the result of historical developments and the failure of the industry to overcome that history. Before 1870-1880, towns grew faster than water systems. People weren't interested in public water supply (everyone had his own well or cistern) and there was no public recognition of water borne disease. It was only after 1900 that the water industry began to provide safe water.

No one wanted water. "Why pay for what they could get free?" This was the universal attitude a hundred years ago. Water systems were installed then for public fire fighting and to lay dust. In order to "sell" a public water supply to the community dwellers the supplier had only one point to offer, namely the convenience of interior plumbing. Since that was not enough, he had to offer the water cheap.

In 1816 when workers received 75 cents per day for labor a water bill was $6 a year, equivalent to eight days' work. Today in the same community the yearly cost of water is equivalent to one day's work. Water rates have not kept pace with inflation.

"Water is cheap", said Mr. Murdock, "because we act as though we must compete with back yard wells by offering convenience of interior plumbing and a low price. In our current advertising we call attention to how cheap water is; we have not gotten over the ideas of a hundred years ago."

What is the result of this too-cheap water. We cannot afford to do the things the customers want done for them. We don't have the money to build the systems or develop the sources we need. We are too poor to strengthen the distribution systems. We can't hire good new men to fill the vacancies left by an aging group of operators,—we are too poor. We simply don't have the money to do a good job of supplying water to our communities.

Who is to blame for present day too-cheap rates. We in the water works industry are at fault. We must change our way of thinking, we must not be proud of cheap water, we should be ashamed of "too-cheap water".

Mr. Murdock was introduced in a novel manner by "Willing Water" who was seated on the stage and spoke (via an electrical transcription) with considerable animation and rolling of eyes.

Honors and Awards

Following the entertainment by the operetta singers on Monday night, honors and awards were presented to several AWWA members.

Honorary Membership to:

ALVIN P. BLACK, Head, Dept. of Chemistry, Univ. of Florida; "a superlative teacher, one who inspires his students to their greatest efforts, a professional man who holds and defends his opinions firmly, a forward-thinking leader of our industry."

HENRY F. CRONIN, Chief Engr., Metropolitan Water Board, London, Eng., "in recognition of his many contributions to the water works profession, particularly for his outstanding leadership of the Metropolitan Water Board with unfaltering courage and steadfast devotion to duty during the Blitz of World War II."

THOMAS J. SKINKER, Commissioner of Water, St. Louis, Mo., a distinguished citizen of St. Louis, "a great credit to a pioneer family which stands high in the traditions of the city. A devoted public servant in his community throughout his lifetime."

W. VICTOR WEIR, Pres., St. Louis County Water Co., "a highly capable engineer, a preeminent administrator. One who has devoted himself unsparingly to the advancement of the water works industry."

The Harry E. Jordan Achievement Award to:

WILLIAM J. ORCHARD, Director, Wallace & Tiernan, Inc.; "for his boundless public spirit, manifested by his long record of unselfish services to the region in which he lives."

The John M. Diven Memorial Medal to:

FRED G. GORDON, Asst. Chief Engr., Bur. of Engr. City of Chicago, "for his constructive leadership and accomplishments in the development through a committee of which he was chairman, of standard specifications for the metal-seated and rubber-seated butterfly valves—of great potential value in water works control and distribution—and for placing the engineering details of production of such valves on a sound and fully professional basis."

The John M. Goodell Prize to:

H. S. SWANSON, J. J. CHAPTON, C. L. KING and E. D. NELSON, of the Los Angeles Dept. of Water and Power for their paper: "Design of Wye Branches for Steel Pipe" as published in the June 1955 issue of the AWWA Journal.

The Distribution Division Award to:

LESLIE PAUL, Supervising Mechanical and Electrical Engineer, East Bay Municipal Utility District, Oakland, Calif. for his paper on "Selection of Valves for Water Works Service" published in the Nov. 1954 issue of the Journal.

The Management Division Award to:

ABEL WOLMAN, Cons. San. Engr. and Prof. of San. Engng., Johns Hopkins Univ., Baltimore, Md., for his

New Directors

Arizona	Ala.-Miss.	New Jersey
D. Travaini Supt. Wat. & Sew. Div. Phoenix, Ariz.	E. M. Stickney Supt. Water System Mobile, Ala.	Chas. J. Alfke Exec. V.P. Hackensack Wat. Co. Weehawken, N.J.

paper titled "Providing Reasonable Water Service", published in the January 1955 issue of the Journal.

The Purification Division Award to:

ARNOLD K. CHERRY, Supt. City Water Works, Cedar Rapids, Iowa, for his paper on "Split Treatment Method of Water Softening" published in the April 1955 Journal.

The Resources Division Award to:

F. B. LAVERTY, Cons. Engr. Pasadena, Calif. for his paper on the "Development of a Fresh-Water Barrier in Southern California for the Prevention of Sea Water Intrusion," published in the September 1955 Journal.

The Harry E. Jordan Scholarship Award to:

MARVIN R. LINDORF, a 1956 Sanitary engineering graduate of the University of California. This award, made by the Water and Sewage Works Manufacturers Assn. provides a fund which will permit Mr. Lindorf to continue his studies in sanitary engineering in the graduate school of the University of California.

The George Warren Fuller Awards to:

Charles W. White	Ala.-Miss.
John F. Rauscher	Ariz.
James S. Peters	Calif.
Wm. L. McFaul	Canada
E.E.T.Y. Duelo	Cuba
C. E. Earls	Florida
Ed. E. Alt	Illinois
Harold S. Griswold	Indiana
Mark E. Driftmeier	Iowa
Albert W. Rumsey	Kansas
Henry M. Gerber	Ky.-Tenn.
Theo. L. Vander Velde	Michigan
Frank E. Dolson	Missouri
Kurt Wiel	Montana
Bert Gurney	Nebraska
Sidney S. Anthony	New England
Walter Spencer (deceased)	New Jersey
Wm. W. Brush	New York
Edward P. Tull	No. Carolina
Wm. Yegen	No. Central
John S. Gettrust	Ohio
Alfred H. Labsap	Pac. Northwest
L. D. Matter	Pennsylvania
Robt. C. Kaufmann	Southeastern
Lonnie C. Eldridge	Southwest
Wm. B. Harman	Virginia
Henry W. Speiden	West Virginia
Henry E. Skibbe	Wisconsin

New Officers

The Association officers elected by the Board of Directors last January took office and were presented to the Association at the annual banquet.

President:
Paul Weir, Gen. Mgr.
Atlanta Water Works
Atlanta, Ga.

Vice Pres.
Fred Merryfield
Prof. San. Eng.
Oregon State College
Corvallis, Ore.

Treasurer
W. W. Brush, Editor
Water Works Engineering
New York, N.Y.

The following persons were elected to serve as division officers for the ensuing year.

WATER WORKS MANAGEMENT

Chairman—L. W. Grayson, Gen. Mgr. & Chief Engr., Public Service Dept., Glendale, Calif.

Vice Chairman—W. W. DeBerard, Dep. Comr. of Water and Ch. Wat. Engr., Bur. of Wat; Dept. Wat. & Sew., Chicago, Ill.

Secy.-Treas.—J. D. Kline, Ch. Engr., Pub. Secr. Sew. Comm., Halifax, Nova Scotia

Trustees—V. A. Appleyard, Philadelphia Pa., and J. J. Garland

WATER PURIFICATION DIVISION

Chairman—H. H. Gerstein, Asst. Chief Water Engr., Dept. of Wat. & Sew., Chicago, Ill.

Vice Chairman—Paul Haney, Cons. Engr., Black & Veatch, Kansas City, Mo.

Secretary—Sherman Russell, Supt. Water Purif., Atlanta Water Works, Atlanta, Ga.

Trustees—J. M. Jester, Hyattsville, Md. and Chas. A. Black, Gainesville, Fla.

DISTRIBUTION DIVISION

Chairman—H. W. Niemeyer, Supt. of Dist., Indianapolis Water Co., Indianapolis, Ind.

Vice Chairman—E. J. Allen, Asst. Supt., Water Dept., Seattle, Wash.

Secy.-Treas.—J. B. Ramsey, Ch. Engr. & Supt., Water Dept., Kansas City, Mo.

Trustees—B. E. Payne, Louisville, Ky. and Henry J. Graeser, Dallas, Tex.

WATER RESOURCES DIVISION

Chairman—H. C. Barksdale, Dist. Engr., Ground Water, U.S. Geol. Survey, Trenton, N. J.

Vice Chairman—C. H. Bechert, Dir., Div. of Wat. Resources, Indiana Dept. of Conservation, Indianapolis, Ind.

Secy.-Treas.—J. W. Cramer, Cons. Engr., Lincoln, Nebr.

Trustees—A. R. Davis, Austin, Tex., and Roy Morse, Washington, D. C.

Manufacturers Assn.

The Water and Sewage Works Manufacturers Assn. held its annual luncheon and business meeting with 476 members and guests attending. Honored guests included 19 past presidents of AWWA, Pres. Frank Amsbary anad Pres. Elect Paul Weir. J. A. Frank, President of the Manufactuers Assn. presided and introduced the speaker, Albin Dearing, Public Relations Counsel to the WSWMA. Mr. Dearing spoke on "Water Resources in Relation to other National Problems."

Following the luncheon, the business meeting was held. Elected to the Board of Governors were:

Chicago Bridge & Iron Co.
U. S. Pipe & Fdry. Co.
Dorr-Oliver, Inc.
Johns-Manville
Ford Meter Box Co.

Officers of the Manufacturers Association elected by the Board to serve in 1957 were:

President—Harry E. Schlenz, Pres., Pacific Flush Tank Co.

Vice President—Richard V. Ford, Vice Pres., Ford Meter Box Co.

Treasurer—Hubert F. O'Brien, Pres., A. P. Smith Co.

John Stewart continues as Manager and Dorothy E. Dimmers as Secretary of WSWMA.

New Directors

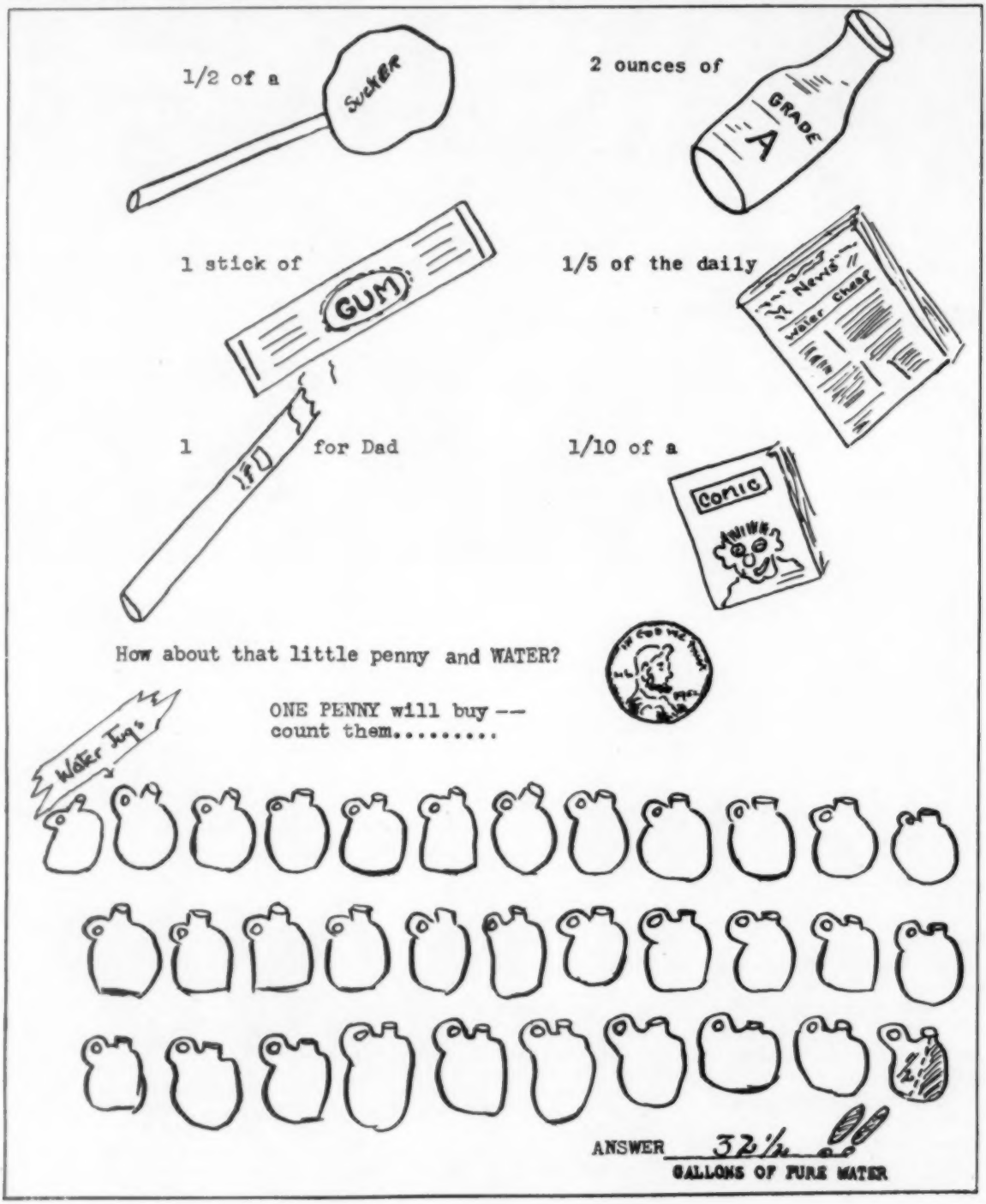
New York	Pac. Northwest	Pennsylvania	WSWMA
John G. Copley	E. J. Allen	L. D. Matter	R. S. Rankin
Gen. Mgr.	Supt.	Asst. Ch. Engr.	Dorr-Oliver Inc.
Wat. Board	Wat. Dept.	State H'lth Dept.	Stamford,
Elmira, N.Y.	Seattle, Wash.	Harrisburg, Pa.	Conn.

What a Penny Will Buy in Avon, N. Y.

One result from a "Public Relations Course" in Avon's elementary schools

RELLY S. CLARK, formerly Supt. of Water for Avon, N. Y., and successor to his father, who for many years was also Avon's Supt. of Water, introduced into Avon's elementary schools a public relations course in "Water Supply Service." That part of the course which dealt with the relative cheapness of dependable, safe water served the community, in comparison with those things most familiar to the children, resulted in the accompanying picturization of "What Your Penny Will Buy." *Water and Sewage Works* believes there's an idea here.

ED. NOTE: Mr. Clark is now sales engineer with Warren Foundry & Pipe Corp. and is serving as Chairman of the Program and Arrangements Committee of the recently organized Western N. Y. Water Works Conference.



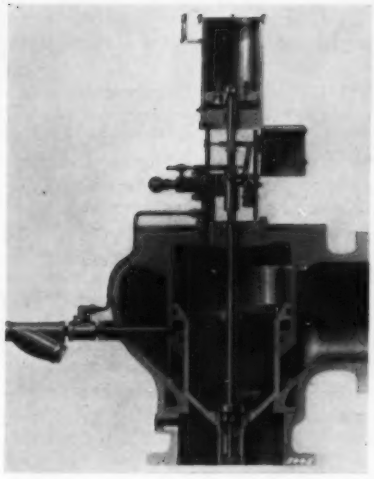


Fig. 1. NEEDLE type surge supressor.

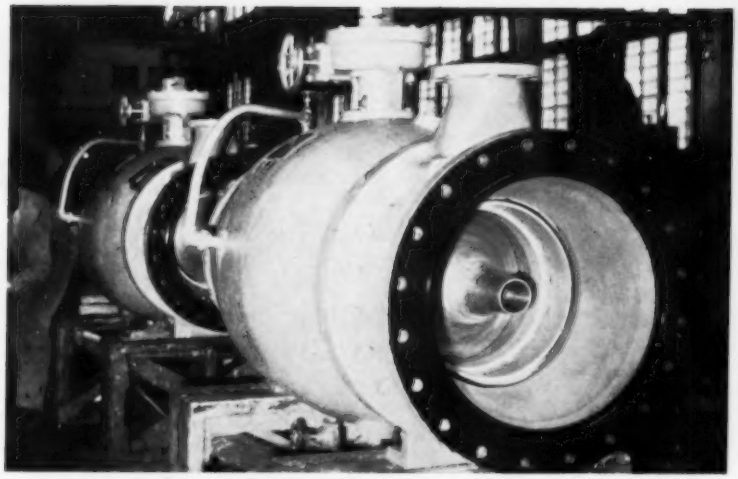


Fig. 2. LARNER-JOHNSON needle type valve (usually controlled hydraulically).

Selecting Valves for Water Service

by LESLIE PAUL

Mr. Paul is Supervising Mechanical & Electrical Engineer, East Bay Municipal Utility District, Oakland, Calif. For this paper, published in the Nov. 1954 AWWA Journal, he was voted the Distribution Division Award. It is here reprinted, by permission of the Association, as a valuable guide in making valve selections.

IN water works systems located on the banks of large rivers or the shores of lakes where the terrain is flat and where water can be distributed through one large, well developed network in one pressure zone, the application of valves and other mechanical devices has evolved into a fairly standardized and comparatively simple pattern. The East Bay Municipal Utility District is not so fortunate, because its 208-sq mile service area, in which it furnishes 114 mgd to 1,000,000 people, varies in elevation from sea level to 1,552 ft. The bulk of the water must be transmitted from the main catchment area in 65-in. and 68-in. pipelines for a distance of approximately 95 miles. The service area is bisected by a main ridge of hills, with branch spurs and steep canyons projecting into the sides, and several other hill systems are also present.

Water works valves can be classified in several ways. One method would be to differentiate between isolating and operating valves. An isolating valve is a device for blocking off a section of pipe in a grid system or protecting operating valves or pumping units, so that inspection or maintenance can be carried out without removing them from the line. An operating valve is one that is used frequently for starting, stopping, or regulating flow or for regulating pressure.

In this paper, valves are divided into seven principal categories: sluice gate, needle, check, butterfly, plug, globe, and gate. There are other types of valves — such as shear gates, mud valves, tide or flap valves, and hydrant valves—which are designed for special applications where selection of type is not a matter of judgment.

Sluice Gates

Sluice gates are used principally on inlet or outlet pipes entering reservoirs, on the side openings of reservoir control towers, and on flume and canal systems where a throttling or shutoff device immersed in the water must take pressure on one side of the leaf only, so that pressure tends to seat the gate.

Sluice gates are obtainable with both rising and nonrising stems, but the use of the latter should be discouraged. The threaded section of a rising stem, being out of the water, serves as a position indicator and can be made of steel. It can be lubricated and no torsional stresses are transmitted to the disc and guides. In the nonrising-stem type, the working parts are immersed in water and cannot be lubricated. The operating nut, rigidly fastened to the disc, and the operating stem must be made of bronze. In operating the gate, the torsional stresses applied to the stem are transferred to the disc and guides. If a sluice gate of this pattern is operated infrequently, the threads of the stem and nut tend to freeze together and the extra torsion necessary to loosen them may break the stem at its point of greatest weakness, the inner end of the threaded section.

Sluice gates manufactured by old, established firms are practical, quality products, standardized to cover a wide range of sizes and pressures. The structural features are well designed and proportioned.

A sluice gate assembly is no stronger than its weakest part. Very often it is the bolting that shows up badly, especially where conditions for setting up galvanic couples are favorable. These may exist where a sluice gate frame is bolted directly to a concrete wall, especially if the bolts are in con-

tact with reinforcing steel. In that event, the steel part imbedded in the concrete will tend to destroy electrolytically the part not so imbedded, the nut deteriorating first. Bolts in contact with bronze parts should be of silicon bronze or equal, to prevent such corrosion. The bolting should be as durable as the castings, and under no circumstances should a steel nut be used on a bronze bolt, or a brass or bronze nut on a steel bolt.

Various kinds of copper alloys on the market are being sold as bronzes. Some of these are not bronzes but different degrees of high-zinc brasses, although the insidious fact is that they all look alike. The word "bronze" should not be used indiscriminately to cover all metals with a yellow color. It is important that the composition of bronzes be described and specified within given limits, in accordance with ASTM or other recognized standards rather than by a manufacturer's trade name. The manufacturer should be willing and able to comply with ASTM or similar requirements.

Valve manufacturers favor certain so-called bronzes for reasons of machinability, cost, and tradition. Many are not bronzes but high-strength, leaded, yellow brasses with high zinc content and thus are susceptible to dezincification in some waters. Hence, such alloys should be avoided in writing valve specifications if better ones are available.

When sluice gates are infrequently operated, and especially when they are not readily accessible, the gate and guide tongues and grooves should be covered or lined with low-zinc bronze, stainless steel, or Monel metal. All sliding, rubbing, or wedging surfaces should be bronze to bronze, stainless steel to stainless steel, or Monel metal to Monel metal.

The safety factor is important in selecting a sluice gate frame for use in waters that cause graphitization, especially if the commonly employed ASTM A126, Class B, cast iron is to be the frame material. A safety factor of five should be an absolute minimum for cast-iron parts subjected to predictable stresses. Sluice gate frames can be flexed very easily, so that bolting and wedging action may produce higher stresses than anticipated if the original installation results in improper frame warping. For guide sections and bolting subjected to wedging action, the safety factor should be much higher, probably not less than fifteen.

The most satisfactory sluice gate installations are those which are flanged and bolted to a flanged wall thimble embedded in the concrete structure. This arrangement makes installation easy, eliminates warping of the frame, and permits removal of the gate without disturbance to the masonry. Gates that are bolted to the masonry are easily warped, as masonry surfaces can never be built true and flat like a machined metal surface, and water leakage between the frame and the masonry can erode away enough concrete to make the installation ineffective as a water stop.

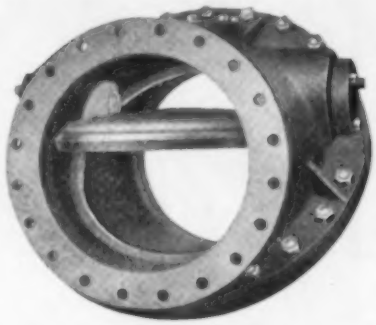


Fig. 3. TILTING-DISC check valve.

Needle Valves

Needle valves (Figs. 1 and 2), in the smaller sizes, are used principally for fine regulation of flow through pilot control mechanisms, because a large movement of the hand wheel results in only a slight movement of the needle with relation to the valve seat. These small, hand-operated valves resemble the globe type, except that, instead of a disc, a streamlined or tapered plug fits into a ground seat. The fluid flows around the plug and through the seat.

In the larger sizes, needle valves have a variety of applications. An important one is the throttling and control of free discharge from reservoirs and pipelines. Medium-size valves are operated mechanically in various ways, but the large sizes are usually controlled hydraulically by the internal-differential method. Because the fluid must flow longitudinally around the outside of the plug, the hydraulic-power elements and the working parts are buried within the body of the valve. A disadvantage of this arrangement is the comparatively high weight of the valve for any given size. Means of getting around this difficulty have received much study, especially by the US Bureau of Reclamation and some of the big power companies that use these valves in very large sizes. The Bureau of Reclamation has improved on the internal-differential valve with what it calls a tube valve, but needle valve design seems to be in a continuing state of modification. (The East Bay system has 22 needle valves, ranging in size from 6 in. to 72 in., all purchased from the same manufacturer.)

The cylinder gate represents an interesting attempt to overcome one of the disadvantages of the needle valve by making the working parts accessible on the outside of the valve. The plug or needle remains stationary, with the point upstream, and a cylinder is drawn back in the upstream direction, which uncovers four ports, causing wide-angle discharge. Where wide-angle discharge is undesirable, a hood can be built to confine the normal expansion of the jet. This valve is capable of discharging a greater quantity of water than conventional needle valves of the same nominal diameter.

The needle valve is sometimes used to regulate flow or pressure in a pipeline, but, when repairs are necessary, the valve body must be removed from the line. (Two of the East Bay needle valves are 6-in. pressure regulators.)

The sleeve valve is another attempt to avoid some of the difficulties of the needle type installed in pipelines. For maintenance or repair, the body and working parts of the sleeve valve can be lifted out of the line without breaking the flange connections to it.

Needle valves may be used as check valves on pump discharges where controlled speed of closing is essential or where the flow must be throttled to a given rate. (East Bay employs one 18-in. and three 24-in. conventional needle valves and three 30-in. sleeve valves for this purpose.)

Needle nozzles are used for controlling the stream jet against the buckets in impulse type water turbines. They are also used for directing the stream in hydraulic mining.

Check Valves

In spite of claims by manufacturers and their sales representatives, there is no such thing as a check valve that "eliminates water hammer." The effect of water hammer may be mitigated by the speed of operation of a certain type of valve under a given set of conditions, but no valve ever nullifies it entirely. Furthermore, a check valve that works well under the conditions imposed by one installation may not work well in another installation. When the velocity of a column of water moving in a pipe is changed, alternating waves of high and low pressure will travel back and forth in the line. Although the check valve may aid in reducing the effect of surge on the pipe system, it may through its own action, create a worse wave system that can be damaging to the line. The primary purpose of a check valve is to prevent reversal of flow. Any of the

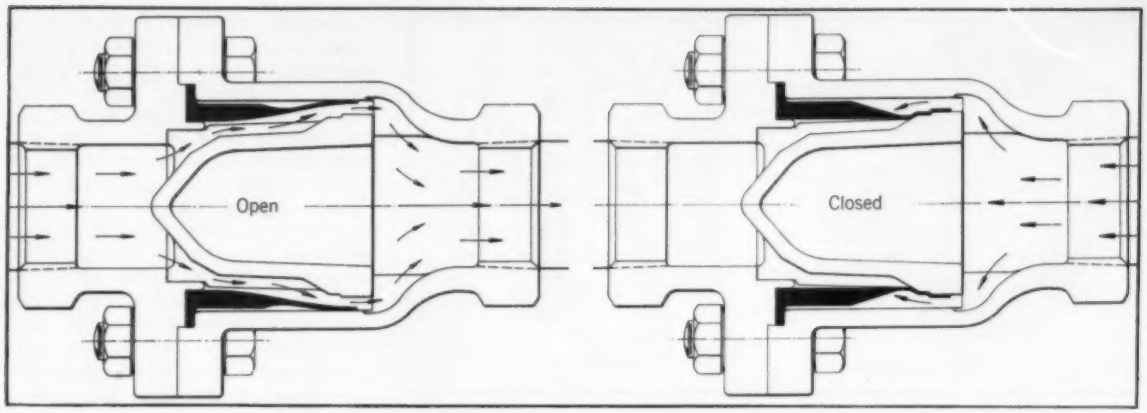


Fig. 4. BASKET type check valve (a check valve that closes very rapidly).

valve types common in the water works industry can be adapted for this purpose; but, under differing hydraulic conditions, one type may be better than the others.

Of the many check valves on the market, the most familiar is the swing check (Fig. 3). It can be single hinged (symmetrically or unsymmetrically) and lever and weight loaded or spring loaded. With either of the last two designs, the loss of head will be increased, because the leaf will be forced down into the stream and the effort necessary to force the valve open will be greater. If, in order to reduce loss of head, a larger valve is selected for a given flow, the velocity will be less and the valve will not open as far. Conversely, if, in order to get the valve open, a smaller valve is chosen, the velocity will be higher and the loss of head will be greater.

If the hinge pins are made of yellow brass, the flap will eventually drop off, because dezincification and friction will combine to ruin the valve.

The great disadvantage of this type of valve is the lack of control over the time of closing. Swing checks are successfully used in numerous manually operated pumping plants where the pump is started against closed gate valves. In such instances, the only hazard is that power failure may cause the check valves to close, with resulting shock. Swing check valves also work satisfactorily in pumping plants connected to well developed grid systems, provided only one pump is operated. If a second pump is utilized in parallel with the first, the stopping of one may cause a damaging metal-to-metal slam on its check valve, but without propagating a water hammer wave.

Some engineers do not trust the newer types of check valves, preferring to rely on the old-fashioned swing check. When they encounter water hammer troubles, they add air domes, requiring periodic air replenishment, or surge pipes, relief valves, or other auxiliary devices that take up valuable space and demand extra maintenance effort. Such arrangements may solve specific problems, but they are often unnecessary if one piece of well chosen equipment will do a comparable job.

In transmission pumping plant lines, where the time of acceleration or deceleration of the water column can be measured, a very fine type of check valve to use is a hydraulically operated, nonlubricated plug valve. In shutting down a plant of this sort, the valve can be so controlled as to close it completely at the instant that the velocity of the water column becomes zero, while, in starting the plant, the speed of opening can be slowed down, so that the compression wave which builds up at the pump when the column is accelerating is reduced to a minimum.

The hydraulically operated internal-differential needle valve previously mentioned can serve a triple purpose as a throttling, check, and pump control valve. The so-called sleeve valve, which is a modified needle type also described earlier, is often used for this purpose.

If a plug or needle valve is used on a pumping installation where the discharge line is very short, it may not be possible to close the valve before the flow of the column reverses direction. In this situation, the valve must be closed very slowly, allowing the pumps to rotate in reverse. There are some pumping plants which operate in this manner. Such valves should not be used if there is a possibility that the shaft sleeves on the pump will unscrew during reverse rotation.

Still another form of check valve is an internally installed, helical spring-operated type in which the disc is at right angles to and moves concentrically with the flow. This type is very effective as a check valve, but the loss of head for a given flow is much greater than for any other kind of check valve of the same nominal size with which the author is familiar.

In a pumping installation where the characteristics of the distribution system require a check valve that closes very rapidly, the basket type, with an expanding elastic "Hycar"* sleeve, does an excellent job (Fig. 4). These valves are marketed in sizes up to 12 in. The variety used at East Bay is plastic lined on the inside. One advantage of this valve is that there is no contact between different metals.

In an automatic pumping installation where the pumps must be started and stopped against closed valves with a regulated speed of opening and shutting, East Bay has successfully utilized a solenoid-actuated, diaphragm-operated, globe pattern valve with the controls built into the assembly (Fig. 5). Internal parts are bronze and the free-floating disc that is pressed up against the head by line pressure has a hollow, stainless-steel stem which slides on a spindle guide so that, in the event of power failure, the disc drops to the closed position almost at the instant that the water column attains zero velocity and before it can reverse. In that respect, this valve is superior to the spring-loaded or lever-and-weight swing check and the loss of head is no greater. (There are 23 electric check valves, sizes 4-16 in., in the East Bay system.)

In situations where swing checks used as dividing valves for combination gravity and transmission pumping to a reservoir give trouble, slow-closing, diaphragm-operated, globe checks

*A trade name of B. F. Goodrich Chemical Co., Cleveland, Ohio.

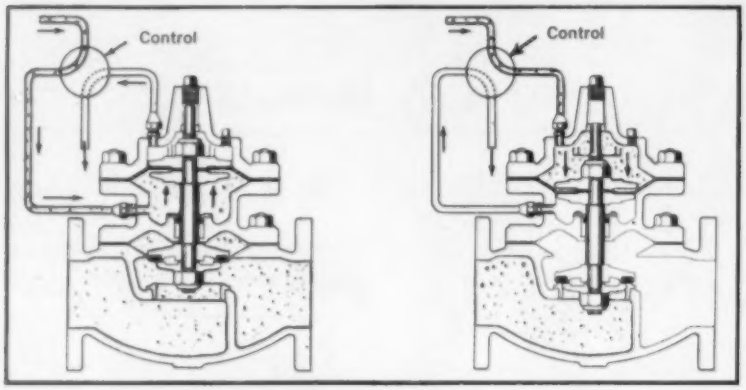


Fig. 5. SOLENOID-CONTROLLED check valve (often used with automatically operated pumps).

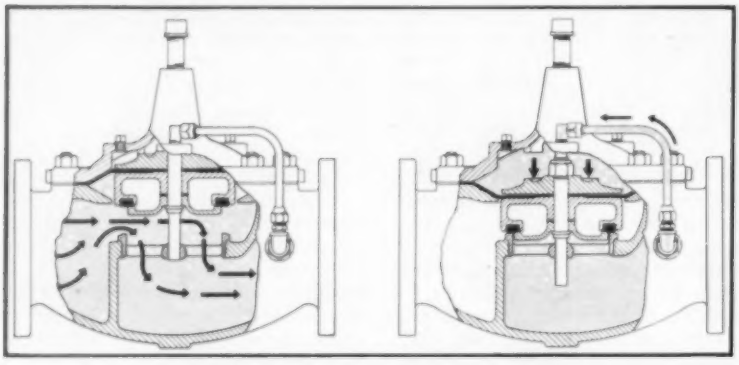


Fig. 6. SLOW-CLOSING globe type check valve (sometimes a substitute for swing checks).

have proved to be very successful shockless substitutes (Fig. 6).

The first automatic pump control valves used at East Bay, in the late 1930's, were gates. At that time it was suggested to some gate valve manufacturers that, because there was a trend toward automatic pump control, it might be well for them to market an assembled, hydraulically operated, solenoid-controlled gate. The suggestion was rejected on the grounds that the factories were set up for quantity production of gate valves and were not organized to handle economically a specialty that did not promise a steady volume of consumer demand.

This refusal led to a search for substitutes, and the need for a self-contained automatic pump control valve has been satisfied by the makers of other types of valves, who could start fresh, without the handicaps of tradition. The first pump control gate valves at East Bay wore out in 1-5 years, depending on how often they were operated, whereas pump control valves of other types have continued in service or have been moved to different plants for further service with practically no maintenance work required on the valve proper.

Butterfly Valves

The butterfly valve, in 4–72-in. sizes, is coming into increasing use in general water works practice, while, in special installations, sizes up to 14 ft are employed. This valve possesses a great advantage in having only one moving part. As now built, butterfly valves can compete in price with the best-quality gate valves, provide tight shutoff, require minimum maintenance, and have a long service life.

For absolutely tight shutoff at pressures of less than 125 psi, the synthetic or gum rubber-lined valve is available as a staple market item (Fig. 7). This type of butterfly is meeting with increasing favor in filter plant installations. For pressures higher than 125 psi, a variety of metal-to-metal seat arrangements, both adjustable and fixed, can be obtained with very low rates of leakage. Butterfly valves can be used wherever any other type is employed in water works practice, except in pipes requiring a full-size round opening through the valves to permit the passage of lining or scraping equipment.

Butterfly valves may be manually or power driven. The low power requirements make it easy to adapt electric-motor or pneumatic or hydraulic drives of either the diaphragm or piston type to these valves. Automatic operation can be full open or shut, or infinite position between these two. Bodies and discs may be of cast iron or cast steel, shafts of stainless steel or Monel, bushings of bronze, vanes with hard chrome edges, and body seats of Babbitt metal or bronze, depending on the use to which the valve is to be put.

Although a longitudinal section through a butterfly valve may make it appear symmetrically balanced, it actually is not. Of the great variety of valves used in water works, the service application of the butterfly requires the closest scrutiny by both the purchaser and the salesman. Overeagerness on the part of the latter to sell a butterfly valve with a light-weight shaft for a service application requiring a heavier one has resulted in incidents that have created unjustified prejudice against a very fine water works device.

Three basic service applications may be classified as follows: [1] a closed system with a limited pressure drop and limited flow, such as at the effluent valve from a filter bed; [2] limited free discharge, such as in a main break downstream from the valve or pump discharge to a dry system; and [3] full free discharge, such as at a valve mounted on the downstream face of a dam. In each of these applications, the magnitude of the seating, bearing friction, hydrostatic, and aerodynamic or flow torques is different. The counter-torque that must be applied to the shaft in each instance determines the size of the shaft. In the closed system, an 18-in. valve, with the disc open 60 deg and an upstream pressure of 50 psi, a downstream pressure of 49 psi, and a flow of 10,000 gpm, will require a dynamic torque of 400 ft-lb to open the valve further. For throttled free discharge, the same valve, with disc open 28 deg, 50 psi upstream, 0 psi downstream, and the identical flow of 10,000 gpm, the dynamic torque required to open the valve further will be 1,200 ft-lb while the torque necessary to close the valve from this position will be 1,000 ft-lb. The same valve, under open-end, free-discharge conditions, with 50 psi upstream, 0 psi downstream, and a flow of 69,000 gpm, will require 6,000 ft-lb to close from this position.

Under some conditions of pressure and flow, the shaft and disc would have to be designed too thick to be practical, and it would be better to

use the disc-arm valve, a modification of the butterfly in which the disc is pulled into the open position from the outer perimeter by a tension bar linkage acting through a stuffing box on the top of the valve (Fig. 8).

There are 26 butterfly valves in the East Bay transmission system—two 42-in. and two 72-in. isolating valves that protect free-discharge needle valves in the downstream face of Pardee Dam; two 72-in. isolating valves upstream from the 10,000-hp Pardee turbines; nine 60-in. turnout valves, for isolating an 8,000-hp and a 5,400-hp transmission pumping plant (one of these valves has a shaft heavy enough to permit closing in the stream); three 48-in. isolating valves on the suction lines of three large pumps; and four 36-in. electrically operated and four 42-in. hydraulically operated butterflies, each linked to an 18-in. needle valve, at eight automatic, synchronous stop and relief valve stations established at 20-mile intervals in the 65-in. and 68-in. transmission lines (the discs and shafting of the butterflies are heavy enough for the valves to be closed in the stream). A break in the line downstream from one of these stations would cause an increase in flow rate, and the venturi effect through the restricted opening of the valve would create increased differential in the float chambers of a mercury U-tube, triggering a tripping closing at the same time as the needle device that would start the butterfly relief valve began to open.

Although butterflies are often used as free-discharge valves, other types on the market would, more often than not, be better suited for this purpose. Anyone who has ever been near a large butterfly valve discharging freely into a downstream pipe section under high head while operating through the critical point in its opening or closing stroke will remember a terrifying experience, but, under normal conditions in a pipeline, these valves are silent, efficient, and easily controlled.

The butterfly valve has one great advantage over other types in its short face-to-face installation length. This, together with the fact that, for sizes 30 in. and greater, a butterfly valve can be purchased for less than any other kind designed and equipped for comparable water works duty, is a good argument for the wider use of butterfly valves in large distribution pipelines.

Automatic Stop Valves

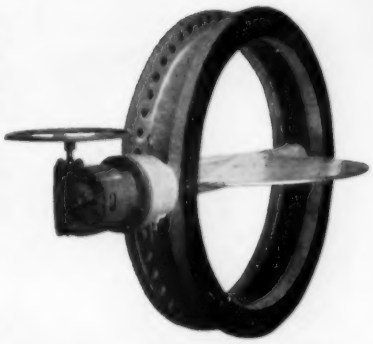
It has been suggested by some civil defense authorities that automatic stop valves be installed on reservoirs in congested areas to conserve storage in the event of a disaster in which the distribution system suffered serious damage. Correspondence and discussions with many water works men have led the author to believe that this arrangement would be highly expensive and impractical for a distribution system. It might even do more harm than good in certain types of disaster where water may be badly needed to put out a fire.

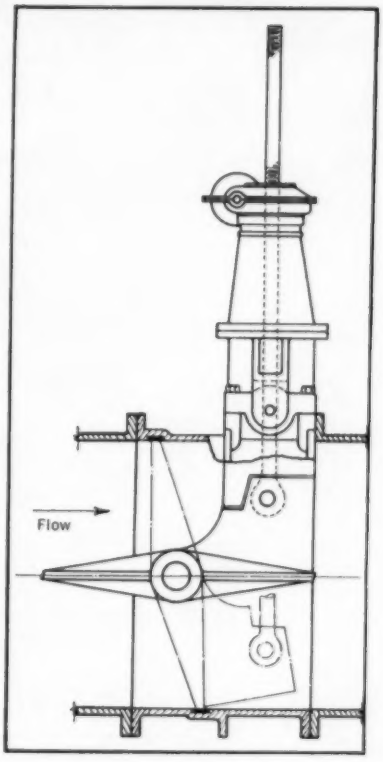
Plug Valves

The plug type valve with one moving part in the valve proper is familiar to every water works man, as it is used in every water service which has a service cock tapped into the main and a curb or corporation cock at the point of service, commonly upstream and just ahead of the meter, if any. Cocks that isolate gages and other forms of instrumentation utilized in the water industry are another application for the plug valve. Still another is the three- or four-way cock used to control pressure on hydraulic cylinders that operate larger valves. The plug valves mentioned are of the dry type and are made of brass when used in water service.

An all-iron lubricated plug valve is receiving increasing attention from water works operators. It can be obtained with a plug opening area equal to 90 per cent of the nominal area of the valve in sizes up to 16 in. In the venturi pattern, it is furnished in nominal sizes up to 30 in. A 30-in. venturi pattern valve would have a plug opening area approximately equal to that of a circle of 19-in. radius; a 24-in. valve, 15-in. radius; and a 20-in. valve, 13-in. radius. Thus, the venturi pattern plug valve would have approximately the same opening area as a butterfly valve of the same nominal size and pressure rating.

The lubricated plug type (Fig. 9) is successfully used by some plants as an isolating valve in grid systems and pumping installations. East Bay employs about 75 such valves, in various sizes, for this purpose in pumping plants and other automatic installations, and about fifteen, in the 16-,





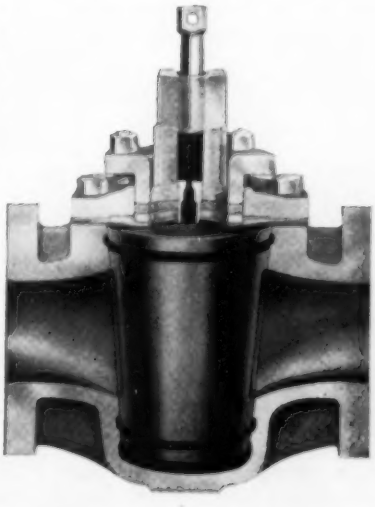


Fig. 7. (Top) RUBBER-SEATED butterfly valve. For absolutely tight shutoff at pressures of less than 125 psi.

Fig. 8. (Center) DISC-ARM pivot valve. This type is a modification of the butterfly valve.

Fig. 9 (Bottom) LUBRICATED plug valve. Successfully used as isolating valves in grid systems and pumping installations.

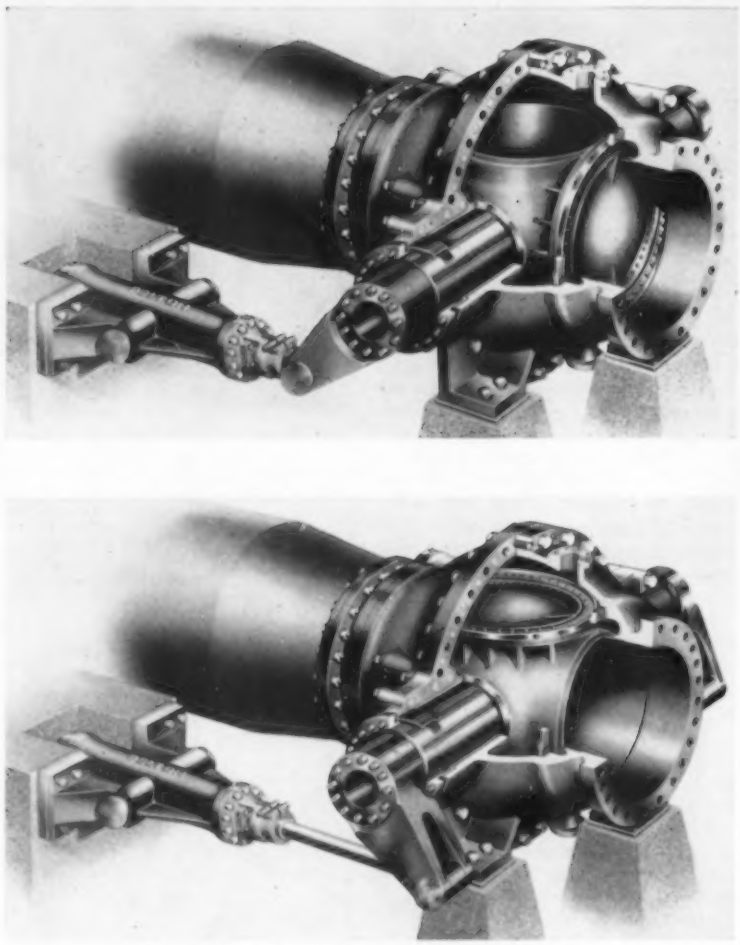


Fig. 10. NONLUBRICATED spherical plug valve. Top—closed; bottom—open.

20-, and 24-in. size, as turnout valves from transmission lines. A 24-in. and a 30-in. plug are used as remote supervisory control water-dispatching valves, electrically operated and controlled through leased telephone lines from a central dispatching point 12 miles away. Another 30-in. plug is used as a float-controlled, hydraulically operated altitude valve. A 16-in., 90 per cent open, manually operated plug is doing a fine job as a throttling valve under very severe conditions. Four-way lubricated plug valves are excellent for filter plant control table manifolds, and East Bay has two filter plants so equipped.

The lubricated plug valve installations at East Bay have been very successful. The main difficulty has been in getting operating personnel accustomed to using new equipment; once they become familiar with these valves and note their ease of operation, however, they want more of them. It is important to remember that, if this type of valve works hard or has a tendency to stick, the stuffing box on the top should be tightened—not loosened as with a gate valve—so that an application of grease through the pressure fitting will jack the plug loose. On one occasion, the 30-in. dispatching valve previously referred to was found to be stuck, but it was easily freed by applying grease and operating it manually. Operation from time to time through a partial stroke has prevented further trouble. Although some water works men have expressed fear that the use of these valves would allow grease to escape into the distribution system, no consumer complaint on this subject has been brought to the author's attention during the 14-year period in which East Bay has employed this type of valve.

The nonlubricated, full-open, conical type of plug valve is another very fine water works valve, which allows smooth, unrestricted flow when fully open. This valve is mechanically jacked up from, or down to, the seat in either the fully open or the fully closed position. Even in the largest sizes, it can be manually operated easily and quickly by one man. (In fact, men accustomed to operating gate valves by sheer brute strength have been known to damage such a plug severely, because they could not bring themselves to believe that a valve, especially one of large size, could be closed so speedily without requiring a crew of laborers to lay their weight against a capstan bar.) The valve can also be operated by water or oil hydraulic power, compressed air, or electric motor. The workmanship in these valves is first class, and a wide choice of high-grade nonferrous metals for mounting in the wearing and seating parts is available, Monel metal being a favorite.

This type of valve offers the following advantages: [1] positive control of valve timing; [2] free, unobstructed flow, with the head loss equivalent to that in a straight piece of pipe of equal length and diameter; [3] no contact between the valve seat and the direct flow of the fluid; [4] operation with full unbalanced pressure, thus eliminating necessity for bypasses; and [5] complete enclosure and full lubrication of all working parts. One of five such valves at East Bay, a 42-in. valve on the tunnel outlet at the upstream end of a 68-in. pipeline 90 miles long, is hydraulically operated through a closed-system air and oil accumulator set. In the event of a break downstream from the valve, the increased flow through a venturi meter actuates a trip mechanism and governing device, which, in turn, automatically causes the valve to close at a fixed speed, regardless of the temperature, the viscosity of the oil, or the magnitude of the break. A 36- and a 30-in. motor-operated valve are used as remote supervisory control rate-setting valves. Two 30-in. valves are employed at strategic locations in a 48-in. transmission line for rapid one-man operation in emergency shutdowns. These valves supplement three of the usual isolating gate valves, which take much more power and time to operate than the plug type. A metropolitan water system with an average consumption about four times as large as East Bay's uses many of these valves in large transmission lines, either in the manner described or as substitutes for the traditional gate valves, but spaced at greater intervals.

The ball valve, a full round opening, nonlubricated plug type, seems to have all of the advantages of other large plug valves and is meeting favor wherever it is used. Mechanical jack-

ing of the plug from the seat before turning is cleverly avoided by setting the plug slightly eccentrically on the shaft, so that the plug seat and the body seat match, with metal-to-metal contact, when the valve is closed. A 16-in. ball valve used for very severe throttling service in one of East Bay's remote supervisory rate-setting stations has so far given excellent results, whereas a manually operated gate valve was destroyed in this installation in less than a year. A 24-in. ball valve is being employed as an altitude valve on a new 12-mil gal prestressed concrete reservoir.

Another plug type valve particularly adaptable to large, high-head impulse turbine installations is the spherical valve (Fig. 10). Like the ball valve, it has very favorable possibilities for use in the water works industry. The rotating plug contains valve seats and a full-open smooth passage for water flow. The valve seats on both the body and the plug are eccentric to the valve centerline and are adjustable to a tight fit, so that they form a positive seal when the valve is closed.

Globe Valves

Globe pattern altitude valves and pressure regulators (Figs. 11 and 12) are on the market in sizes up to 36 in. in diameter. The globe valves in the East Bay system include 142 pressure regulators, 59 altitude valves, and 21 float valves, 2–16 in. in size.

The globe valve is such a commonplace item that everyone takes it for granted without realizing its widespread importance. There are very few people in the civilized western world who do not at some time during the day operate a globe valve in a water supply system. The washbasin, kitchen sink, shower, and bathtub are all supplied with water whose flow is regulated by some modification of the globe valve. The float valve in the toilet tank and the hose bib in the garden are globe valve patterns familiar to all. Early in the history of the plumbing supply industry, this valve evolved as the practical answer to the need for a device to throttle or regulate the flow of water and steam. In its simplest form, as either a globe or angle valve, a disc is forced down by a screw against a circular seat. The disc and screw constitute a single moving part in the smaller valves but in some modifications of the larger valves the disc is free to pivot on the end of the stem. As a throttling device, there has never been anything on the market to compare with the globe valve in economy, versatility, simplicity, and rugged durability.

Hand-operated globe valves are less expensive than gate valves of the same size and are very much easier to repair in the line. By removing the head, the stem and disc can be lifted out, and the body seat ring can then be unscrewed for repair or replacement. Because there are no sliding parts except the screw and stem, the wear comes only from wire drawing on the disc and seat ring and does not occur for many years. Hydraulically operated globe valves of either the piston or diaphragm type are just as durable as the manually operated types. Although the driving mechanisms need occasional diaphragm, cup leather, or O-ring replacements, the interior metal parts of the valve proper are easily accessible and go for long periods without repairs. A pressure regulator that had received very hard usage over 31 years was recently removed from the line only because replacement parts were no longer available. Hydraulically operated globe valves require very little power, as the line pressure imposed on the upper side and relieved from the bottom side of the diaphragm or piston is sufficient to close or open the valve at a controlled speed. Most manufacings for pressure regulators, altitude valves, relief valves, electric pump controllers, and slow-closing checks by varying the pilot control and diaphragm mechanisms.

The one disadvantage of the globe valve is the loss of head due to the devious path that the fluid must follow through it. For pressure regulators, however, this is an advantage, because energy must be dissipated anyway. If a globe valve is used as an altitude valve in installations where all of the water pumped does not reach the reservoir served by the valve (because some is intercepted by consumers), the valve size is generally determined by the required rate of withdrawal from the reservoir, which is higher than the pumping rate to the reservoir. The withdrawal rate can be augmented by introducing a swing check valve into the bypass line around the altitude valve.

Where pumps must be automatically started and stopped against a closed valve, the globe type, solenoid-controlled check valve previously described is a superior device for this purpose.

Air valves and vacuum valves, often built in combination, are very difficult to classify because there are so many kinds on the market, but most of them are either of the globe, needle, or poppet type, which can be considered variations of one another. Air and vacuum valves are used mostly for

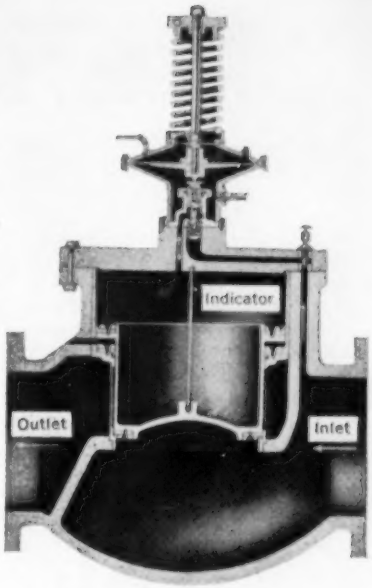


Fig. 11. GLOBE PATTERN altitude valve.

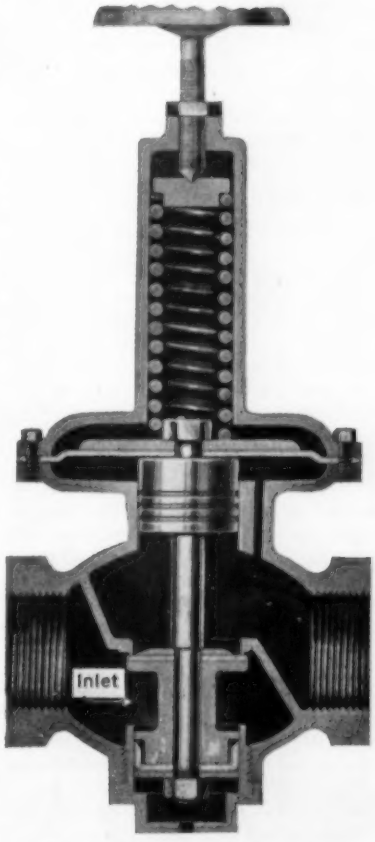


Fig. 12. PRESSURE-REDUCING globe valve.

relieving entrapped air from the high points in pipelines or for admitting air to the pipeline whenever the pressure inside of the pipe becomes less than atmospheric.

Large quantities of air enter the pipeline systems when breaks occur or when lines are opened for connections or repairs. When such a line is again placed in service, the air works its way to the high points, and, if it is not entrapped and released through air valves before it reaches an altitude valve or pumping station, it sometimes causes damage to equipment and inconvenience to consumers.

Vacuum valves are often unnecessary if pipes are lined and coated with Portland cement mortar or if they are buried in well compacted material. Data obtained from experiments on a 48-in. steel pipe with a wall thickness of ¼ in. and on a 36-in. steel pipe with a wall thickness of $\frac{3}{16}$ in. show how Portland cement lining and coating strengthen large-diameter pipes to a remarkable degree against collapsing *(1)*.

Early in 1951, three 54-in. dipped and wrapped tunnel outlet pipes with $\frac{7}{16}$-in. wall thicknesses, buried parallel to each other, were subjected to a vacuum of 29 in. of mercury or 14.2-psi external pressure for about 40 min without apparent damage. The same pipes, if unburied, would have collapsed under such a vacuum.

Gate Valves

Gate valves are installed by the thousands throughout the land, but they remain almost always in the wholly open position, because most of them serve as isolating valves in distribution grid systems or as protection for operating valves. A smaller number are employed as dividing valves between pressure zones, remaining closed except for inspection or an occasional emergency.

Water works gate valves are of either the solid-wedge or the double-disc, parallel-seat type. The stems can be rising or nonrising, but only the nonrising-stem valves are practical for direct burial in the ground. Even though these types have evolved through experience and tradition as the practical water works grid system valve, both have serious faults and leave much to be desired in the way of improvements in design. Because they are so common in the water works industry, they are often used as operating valves where other types would serve a great deal better.

Efforts to overcome some of the disadvantages of the gate valve have resulted in the development of the ring follower, paradox, and ring seal gates as main stops for isolating powerhouse water turbines and free-discharge operating valves in sluiceways and dams. These gates have been built to various designs and in large sizes for the US Bureau of Reclamation.

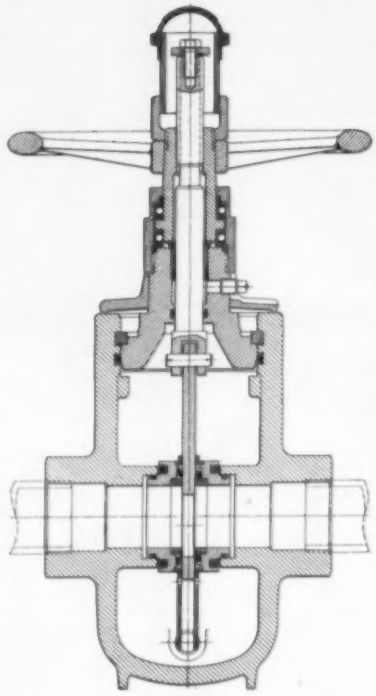


Fig. 13. RING FOLLOWER type gate valve with O-ring seats.

An interesting gate valve pattern, manufactured on the West Coast, is finding wide acceptance in natural gas and oil pipelines and in refinery use. It is of the ring follower type, with stainless-steel interior parts and O-ring seats, which make possible a bubble-tight valve that can be put through thousands of opening and closing operations without showing signs of wear or damage to the O-rings. This valve, which is successfully displacing other types, can be purchased in sizes up to 36 in. at prices competitive with some valves used for operating purposes in the water business (Fig. 13).

Throttling is the most severe service to which a valve can be subjected. Of all the valves utilized in this way, the double-disc gate is the least durable, and it should generally be limited to service as an isolating valve, an application in which, owing to its relatively low initial cost, practical experience has found it to excel. If a gate valve is intended for throttling service, the solid-wedge variety, with close-fitting guides, should be selected. Square-bottom and beamed-waterway double-disc types are widely used as wash water valves in filter plants, under conditions of low head and velocity.

The beamed-waterway double-disc valve is equipped with bronze-faced beams located in the downstream part of the valve body. Bronze strips on the downstream disc match and are opposite the beams, and the disc and beam facings are flush in the same plane with their respective disc and seat rings. This arrangement prevents the disc from tipping obliquely into the seat ring and very effectively prolongs the life of the valve. The square-bottom valve has shoes that are attached to the downstream disc at three points and slide on tracks, two in the valve body and one in the bonnet. In this manner, the disc is held away from the seat until the shoes slide off the tracks at the end of closing travel and allow the disc ring to engage the seat ring without scraping. These valves can be of either the "single" or the "double" square-bottom type, according to whether the flow through the valve is to be in one direction or two. Although the beamed-waterway and square-bottom arrangements save wear on the seats, a disproportionate amount of power is still needed for operation, and bypass valves and gear trains or hydraulic cylinders are necessary accessories to most gate valves larger than 16 in. in size.

Gate valves can be power operated by any of the methods used for any other type, but the power requirements of the former are much greater because of the sliding parts. The most common means of operation are hydraulic cylinders and electric motors, but pneumatic operation is coming into wider use.

In general, East Bay uses nonrising-stem double-disc valves for direct burial only. For isolating valves in pumping plants or other installations where the valve is in the open or in a pit and there is sufficient room to accommodate the extra length, the rising-stem valve is utilized. Some 90 per cent open, lubricated plug valves are also employed for the latter purpose.

The solid-wedge type has two moving parts in the valve proper, both of which are subject to unlubricated sliding friction, where the square- or acme-threaded stem screws into the wedge and where the wedge guides slide on close-fitting guides in the valve body. The wedge is usually of

solid brass or bronze or, like the body seat rings, brass or bronze mounted. The wedge faces do not come in contact with the seats until the valve is closed. If the valve remains in the open position for a long period in a grid system carrying water that causes lime or other solid matter to deposit or tubercles to develop in the recess between the seats, the valve will not close completely and too much effort to force it will break the stem. Also, if this valve is installed in the tightly closed position when the temperature is high and is left closed after cold water has been introduced into the system, it may be very difficult to break the valve loose to open it. The valve has a tendency to stick in the closed position even when there is no temperature change. A number of manufacturers produce these valves only in the smaller sizes, which are used by some large water works systems in great quantity. The solid-wedge valve is favored in some industrial, refinery, and steam plant applications. An advantage of the solid-wedge gate lies in the fact that it can be installed and operated in any position—horizontally, vertically, upside down, or with the leaf in a horizontal plane. (East Bay discontinued the use of single-wedge gates about 15 years ago because they are difficult to repair, especially in setting them up in machines for accurate refacing so that the wedge faces on the disc and body could be fitted true and tight.)

The double-disc, parallel-seat gate is an awkward mechanical device, with four to ten moving parts in the valve body proper, each of which slides or scrapes without lubrication against some other part. Double-disc gate valves are designed primarily for use in the vertical position with the stem upright, but they can be operated in the horizontal position. The loose parts of the wedging mechanism work best when hanging in the vertical. Valves 16 in. and larger, installed horizontally in horizontal pipelines, should be equipped with tracks, rollers, and scrapers. The installation of double-disc gates in vertical pipelines should be discouraged, even if tracks are placed in the bonnet to support the edge of the lower disc. Double-disc valves will not operate upside down or at any angle with the stem below the horizontal, because the wedging mechanism engages and jams the discs against the seats. Moreover, accumulations of solid matter trapped in the bonnet will interfere with the operation of the valve.

Nearly every manufacturer has his own method of spreading and wedging the discs against the seat rings in the closed position. The advantages of some of these methods are subject to argument. A single good standard design for a wedging device in gate valves is badly needed. For valves 12 in. or smaller, this design should permit the stem to be changed with the discs wedged closed and the line under pressure.

As the two discs hang loosely inside the valve bonnet, the downstream disc edge tips into the waterway and gouges into the seat ring at a slightly oblique angle when the valve disc passes between the open and closed position, causing uneven wear on these parts. If a double-disc valve is allowed to remain in a partly open or throttled position for any length of time, the constant vibration or chattering of the discs in the stream soon causes wear in the small links required in some designs to hold the leaves parallel; when the links finally wear through and come off, enough displacement of the discs often occurs so that the hooks and wedges drop out and are carried away in the stream. Gate valve parts have occasionally been found at considerable distances from the places where the valves were located.

In the double-disc gate, the outside of the two discs and the protruding end of the stem are the only portions of the moving parts that can be seen without disassembling the valve. The other parts are hidden from view between the leaves or in the bonnet of the valve.

East Bay recently sent a questionnaire to some gate valve manufacturers and large users in order to establish a cross section of opinion on what constitutes good practice for gate valves equipped with grease cases and intended for direct burial. Not only were the answers conflicting, but some manufacturers even contradicted themselves when the same question was asked in a different way. There appeared to be no standard practice based on factual observation of or experience with grease cases among either users or manufacturers. Some of the latter seemed to have an unsympathetic and unrealistic attitude toward the users' problems and gave the impression that, as long as gate valves are made and sold in the traditional manner, the user should be satisfied with what the market has to offer. One or two suggested that, even though the grease was driven from the case by water under pressure, the valve could still be operated.

It must be concluded from the questionnaire returns that manufacturers and users of gate valves do not know whether or how long an integral type of gear case remains free of water after the valve has been installed. The attitude seems to be that what cannot be seen cannot be known and what is not known is not important. Yet what assurance is there that, in an emergency, a large distribution line gate valve can be closed if it has remained untouched for a long period, with discs forced out against the top of the body seat rings by tuberculation and corrosion products?

Based on experience during the past few years, very rigid specifications on gate valves have been drawn up by the East Bay District. These specifications require delivery of the larger gate valves to East Bay shops for dismantling and inspection. Any valve that is not in compliance with the specifications must be corrected.

Conclusion

A variety of good check valve types is available on the market, some one of which, in any given situation, are better than the others.

The traditional gate valve, up to 16 in. in size, has earned top consideration in the water works industry as an isolating valve.

The traditional gate valve is the least durable and the most difficult to operate of all valve types practical for water works service. Users of valves in sizes 24 in. and larger would do well to consider the application of various types other than gate valves, regardless of whether they are intended for isolating or operating purposes.

Acknowledgment

The cooperation of valve manufacturers in furnishing illustrations used in this paper is gratefully acknowledged. Names of manufacturers have been omitted throughout, in order to avoid the implication, erroneous in some instances, that the same type of equipment is not available from other firms.

Reference

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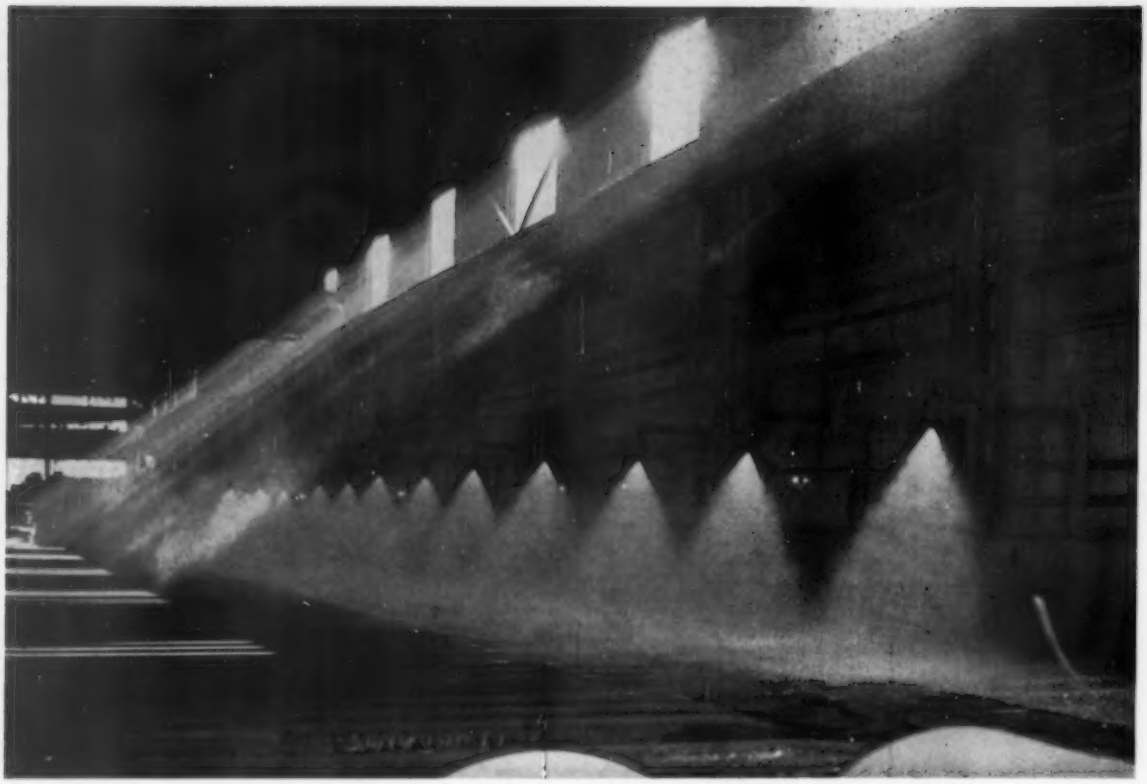

JETS of industrially clean water spray rolled steel plate in final cooling process

How Cleaning A Turbid Water Supply Saved Over $100,000 Annually

A Story of Benefits Derived from Dominion Foundries' New Water Treatment Plant

by D. O. DAVIS
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Hamilton, Ontario

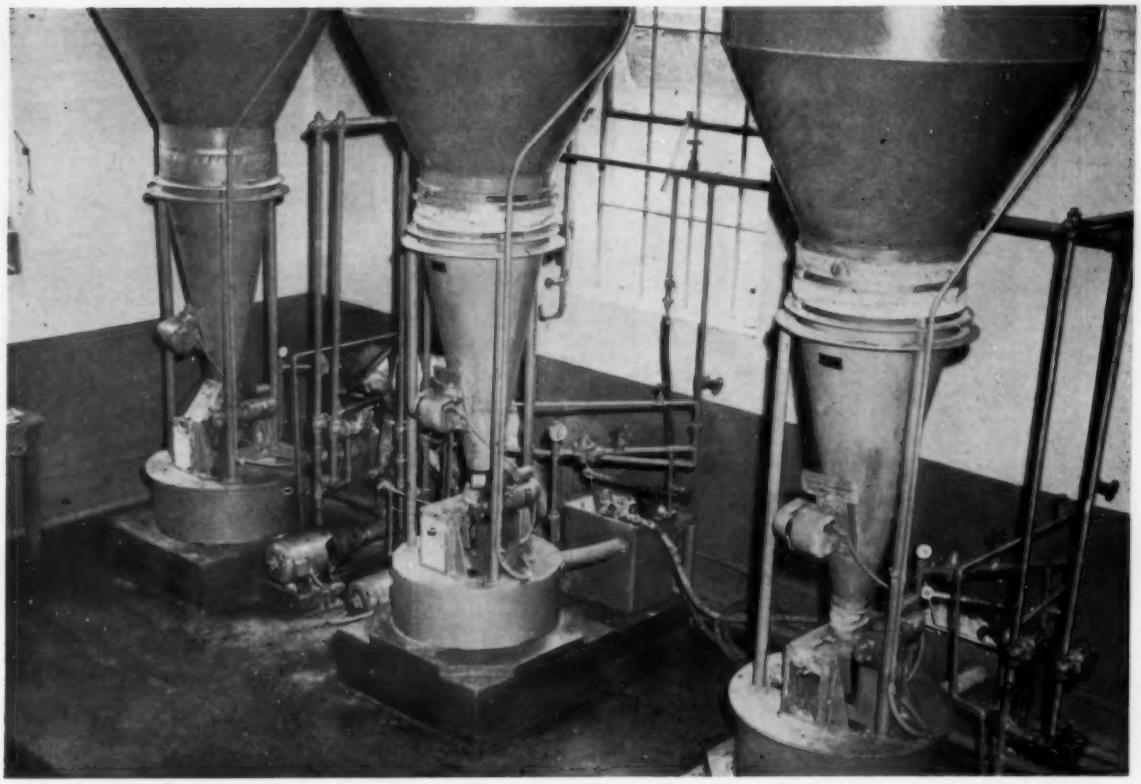
EFFICIENT WATER UTILIZATION is one of the most urgent problems currently facing industry. Water is required for boiler feed, processing, cooling, sanitary facilities, fire protection and other services. While these demands are constantly increasing, reports indicate that water supplies in many sections are rapidly becoming depleted. Frequently, reuse of the available reserves is imperative. In other instances, making use of turbid and otherwise unsanitary waters is becoming a necessity.

This latter situation has fostered a trend toward the use of more complete water purification systems to eliminate the troublesome physical, mineral and chemical impurities which would interfere with the operation of process equipment.

The purification of waters containing industrial and other wastes is always a troublesome task. First is the problem of constructing the necessary equipment for the transformation process, second is the degree of purification that is required, and third is the application to which the water will eventually be put after its treatment.

Purification of a water to be used industrially in various cooling processes was a serious problem for Dominion Foundries and Steel Limited, Hamilton, Ont. Known throughout Canada as "Dofasco", this company has within the past five years, approximately $50 million in various expansion programs. This vast expansion program produced a big headache. It created a need for larger quantities of water which had to be industrially cleaned and odor free, reasonably priced, and suitable for utilization in cleaning manufactured bar stock and cooling the rolling mills.

It became apparent to Dofasco in 1952 that it would be profitable to operate a water purification plant, their own, as completion of the early phases of the expansion program was beginning to make the water supply a costly proposition and complicated as well. Daily requirements at that time were in the vicinity of 9 million Imperial gallons. Of this total, Dofasco was using 4.5 million gallons of city-treated water at a cost of $0.15



THREE OF FOUR Permutit chemical feeders dosing lime, alum and clay into bay water supply during treatment

per 1,000 gallons. This meant an annual bill from the City of Hamilton of approximately $250,000.

The balance of these 1952 requirements—4.5 million gallons—was drawn through the company's own pumps from the "rather murky and very turbid" water of nearby Hamilton Bay. Maximum turbidities ran over 200 ppm and averaged over 40 ppm. Furthermore, these high turbidities often lasted for periods of one to two weeks. This was further complicated by contamination with chemical wastes and sewage. Additionally, the pH of the raw water often went down to an average of 5.0 when acid wastes from surrounding industry were dumped into the bay. At that time, the supply was screened to remove coarse solids. However, mud, silt and other finely divided material was not removed and as a consequence the pipes and mains carrying the water would clog from time to time and present costly maintenance and repair problems. Furthermore, odor from the bay water as used in the plant processes was anything but pleasant.

To complicate the situation, the City of Hamilton's own pumping and filtration facilities were often being strained in periods of hot weather. Peak domestic demands, coupled with Dofasco's usage, sometimes meant that certain sections of the city would have low water pressure and be short

FLOW CONTROL is by hydraulically actuated valve

CHLORINE FEEDER (left) helps kill odors and any original oxygen demand; two Precipitators (right), used for softening and coagulation, have their sludge levels controlled by photoelectric "eyes"

of water. This prompted official requests from the city fathers to Dofasco and other industries in Hamilton to "try-to-go-easy" on utilization at these times. Therefore, the company felt a moral obligation to relieve the shortage and at the same time make itself partially independent of the city system.

Thus, when the decision was made to install and operate its own water purification plant, Dofasco put itself in a position to gain four important benefits, as follows: 1. Secure a plentiful supply of water. 2. Fulfill its moral obligation to use less city water. 3. Save money. 4. Make working conditions more pleasant for its own personnel.

Therefore, Dofasco engaged the Permutit Company of Canada Ltd., a subsidiary of The Permutit Company, New York City, to install equipment to purify the water drawn from Hamilton Bay. Two Precipitators for (a) coagulation and settling or (b) coagulation and settling plus softening, each with a capacity of 5,200 Imperial gallons per minute, were constructed. Each of these units is 47 feet wide by 96 feet long by 17 feet deep.

Four chemical feeders, to treat the water with lime, alum, clay and, when required, sulfuric acid, were also installed. This installed equipment has a rated capacity of 15 million Imperial gallons daily (18 million U. S. gal.), which is more than required at present but takes future demands into consideration.

Costs

The purification plant has been in operation since March 1954. Dofasco is now using industrially clean water furnished by the Permutit system at a cost of only $0.04 per 1,000 Imperial gallons, in place of the city-treated water at a cost of $0.15 per 1,000 gallons, cutting costs by about 75 per cent. The plant is expected to pay for itself in from four to five years.

Comparative costs are hard to assess at this point because of the company's vastly increased use of water since 1952. Now, with increased production and processing, overall use of water has increased from 9 million to 11 million Imperial gallons daily. However, demand on the city supply has been cut from 4.5 to 3 million Imperial gallons in the same period. Thus, the direct reduction in city water charges is about $100,000 annually, including the difference in cost if city water had been purchased to take care of the additional demands.

It has been estimated that the total cost of the water treating project was $575,000, of which $100,000 represents Permutit engineering, chemical feeders, purification and control euipment. At present, the purification system treats an average of 8 million gallons of Hamilton Bay water daily. Average total cost of operating the equipment is $323 per day, or $0.04 per 1,000 Imperial gallons (1,200 U. S. gal.). A realistic figure of the yearly maintenance cost is not available as yet due to the fact that the plant has been operating for such a short period.

Performance

The four chemical feeders distribute almost three tons of chemical per day and average dosages represent 1,500 pounds of lime, 2,700 pounds of clay, and 1,400 pounds of alum and occasionally some sulfuric acid. With these chemicals added to the turbid supply, the raw water is thoroughly mixed by baffles before entering the Precipitators, at a valve controlled rate, for coagulation and filtration. This controlled flow maintains water at the proper level. Height of the sludge blanket in the units is automatically controlled by photoelectric cells operating a beam of light shining through a continuous thin stream of water drawn from a pre-selected level in the up-flow sludge filter compartment.

This treatment reduces turbidity of the "rather murky and highly turbid" raw water to an average of 5 parts per million, making it entirely suitable for industrial utilization. It also brings the pH of the raw water from an acid condition of 5.0 to 6.0 to a slightly alkaline condition of 7.5.

An abundant supply of clarified water to meet present and contemplated future requirements, combined with a minimum of labor, only minor repairs and other maintenance costs, and a substantial savings already apparent, all attest to the satisfactory results realized from the installation.

WATER WORKS PRACTICES

Tastes and Odors—Part 1

The thirty-first of α series

by GEORGE E. SYMONS, Ph.D.

Dr. Symons is Consultant and Technical Editor, Larchmont, N. Y. In this series he discusses *Water Works Practices* in the form of short course lectures. These are designed to assist plant operators, students, and all who wish to review fundamentals in this field.

A . . . Introduction

1 . . Definitions

a. Tastes are sensations which are perceived by the taste buds in the tongue. There are only four tastes: sweet, sour, bitter, and salty.

b. Odors are perceived by the olfactory nerves high in the human nose.

(1) There are four basic odors:
. . . Sweet or fragrant
. . . Sour or acid
. . . Burnt
. . . Goaty

(2) Combinations of basic odors in various concentrations are limitless and therefore the number of odors a person can recognize is without number.

(3) Both the lay public and water works engineers consider tastes and odors as one problem and seldom distinguish between the two.

c. Palatability is the term describing the agreeability of a water to the physical senses, sight, taste, smell and touch.

2 . . History

a. The history of taste and odor control as a means of effecting palatability is briefly told in a few dates.

(1) 1807—Bone char filters used in England

(2) 1860—Aeration tried and adopted at Elmira, N. Y.

(3) 1873—Dr. Gorfield of the School of Military Engineering in England stated that "drinking water must be without taste and smell."

(4) 1904—Copper sufate used for algae control by Kellerman and Moore of U.S. Dept. of Agr.

(5) 1917—Joseph Race at Ottawa, Ont. used chlorine and ammonia to reduce cost of disinfection and found improvement in tastes and odors.

(6) 1919—Sir Alexander Houston inaugurated scientific studies of tastes and odors in London.

(7) 1922—N. J. Howard at Toronto, Ont., Can., experimented with superchlorination.

(8) 1926—J. W. McAmis at Greenville, S. C. made first successful plant scale test of ammonia-chlorine treatment for tastes and odors. (By 1933, 35 per cent of supplies treated for taste and odor used this method.)

(9) 1927—Powdered activated carbon was used for taste and odor control by two meat packing plants in Chicago.

(10) 1928-29—Research on granular activated carbon by Baylis in Chicago and Sierp at Hamm, Germany.

(11) 1930—G. R. Spalding at New Milford, N. J. (Hackensack Water Co.) used powdered activated carbon on a municipal water supply to remove successfully odors caused by an alcohol denaturant, aldehol.

(12) 1939-40—Free residual chlorination (the break point process) introduced by Wallace & Tiernan, Inc. researchers.

(13) 1943-44—Chlorine-dioxide introduced as a new chemical for the treatment of tastes and odors.

b. More than 1100 articles have been written on the subject of tastes and odors in water. The best source of a bibliography on the subject is the Industrial Chemical Sales Div. of West Virginia Pulp & Paper Co.

B . . . Fundamentals

1 . . Sources of Odors

a. Odors in water are caused by volatile substances, either organic or inorganic. Most of these substances exist in the reduced state.

b. Both odors and true tastes may arise from either natural or man-made sources.

(1) Natural sources include decomposition of organic matter, organisms which produce volatile odorous compounds, and mineral deposits.

(2) Man-made sources include sewage which is subject to decomposition, industrial wastes and water treating chemicals.

2 . . Odor Enhancement.

a. Many odors in water supplies are enhanced, or increased by chemical treatment in water plants (See Sect. C-8d)

b. Odors in water supplies usually are more easily perceived in hot water and odors not objectionable to the consumer in cold water may become so when the water is warmed.

3 . . Odor Removal

a. The nature of substances causing odors has a definite bearing on the means employed to remove them.

b. Methods of removing odor-causing substances fall into three classes.

(1) Desolution by gas exchange or aeration

(2) Adsorption of substances on the surface of an otherwise inert material.

(3) Oxidation of reduced component of the odor substance or total destruction by oxidation.

C . . . Specific Causes of Odors

1 . . Algae (Plankton)

a. Until about 1945, it was generally believed that most odors in water supplies were the direct result of algae growths.

(1) Tastes and odors were considered to be caused by volatile oils released by various algae either during the growth phase or upon death and decomposition.

(2) Following World War II, Prof. J.K.G. Silvey at North Texas State College reinstituted studies which later indicated that many, if not all, tastes and odors generally accredited to algae were actually caused by a ray fungi, called actinomycetes. (See discussion under Sect. C-5)

b. Algae are microscopic plants which contain chloryphyll and/or other pigments which permit them to utilize sunlight for energy, releasing oxygen and consuming carbon dioxide.

c. Algae are classified according to pigmentation.

(1) Blue-green algae (Cyanophyceae or Myxophyceae) may occur as single cells, filaments, or colonies.

(2) Green algae (Chlorophyceae) may be single or many celled, motile or non-motile.

(3) Diatoms (Bacillariophyceae) are yellow-green, generally single celled. They have silica-impregnated cell walls and many types are motile.

(4) Yellow-green (Heterokantae) and yellow-brown (Chrysophyceae) are not often encountered in water supplies.

d. Algae blooms on surface water reservoirs, streams and lakes occur when the growth is so rapid as to be considered "runaway" and the entire surface of the water is covered with a heavy accumulation of the organisms.

(1) Blooms generally occur in the warm summer months.

(2) Rapid growth is enhanced by the presence in the water of nutrients, particularly nitrogen and phosphorous compounds. . .These "fertilizing" substances may come from sewage or other wastes discharged into the water.

(3) Since strong tastes and odors are associated with heavy growths of algae, one of the most common means for control of tests and odors is to control the growth of algae.

. .Algae control requires study of the type of organism and careful use of an algicide. (See section on preventive treatment, later)

e. Types of algae odors and the organisms generally associated with these odors are:

(1) Grassy, usually blue-green algae—

Anabaena
Aphanizomenon
Clathrocystis
Coelosphaerium
Cylindrospermum

(2) Fishy (sometimes grassy) usually green algae—

Cladophora
Closterium
Dictyosphaerium
Eudorina
Pandorina
Ulothrix
Volvox

(3) Aromatic or geranium (sometimes fishy), usually diatoms—

Asterionella
Cyclotella
Diatoma
Meridion
Synedra
Tabellaria

2 . . PROTOZOA

a. Protozoa are miscroscopic unicellular animals, most of which are free swimming or motile.

b. Protozoa are divided into three classes

(1) Amoeboids, irregular in shape, naked or shelled, occur singly or in colonies with movement provided by false feet or pseudopodia

(2) Flagellates, characterized by whiplike or lashlike appendages, occur singly or in colonies, naked or with a cellulosic shell.

(3) Ciliates, also termed infusoria are covered with hairlike appendages and occur singly or in colonies.

c. Most protozoa are bacteria eaters and as such are scavengers; some apparently impart characteristic odors to water during the growth phase; all may impart odors on death.

d. Types of protozoan odors and the organism generally associated with the odors are:

(1) Fishy—

Bursaria
Ceratium
Glenodinium
Peridiuium
Uroglena (Uroglenopsis)

(2) Aromatic (Violets)

Cryptomonas
Dinobryon
Mallomonas

(3) Cucumber

Synura

e. Organisms toxic to fish are typified by the dinoflagellates which cause the red tides off the Florida coast.

3 . . METAZOA

a. Moss animals and sponges may cause troubles other than tastes and odors but will cause odors on decomposition.

b. Bryozoa, a moss-like animal may grow on filter walls and may reach large size.

c. Hydrozoa occur singly but grow in large numbers in water reservoirs and slow sand filters.

4 . . BENTHOS

a. Organisms which are attached to or grow in the bottom of surface supplies are called Benthos. These are not weeds and do not emerge above the surface of the water.

b. If the water level drops and Benthos organisms become exposed to the air, decomposition will result and odorous compounds will usually get into the supply.

5 . . FUNGI

a. Prof. Silvey has shown that actinomycetes, belonging to the genus *Streptomyces,* and known as ray fungi, will grow profusely in water in the presence of organic nutrients and will produce, earthy, hay-like, manurial, fishy, geranium or aromatic odors.

b. These actinomycetes will also grow profusely in algae as hosts and will produce odors commonly associated with certain types of algae such as the diatoms, *Melosira;* the blue-green algae, *Anabaena;* the green algae, *Cladophora.*

c. Prof. Silvey concludes that tastes and odors in water supplies are by-products of various actinomycetes growing in association with algae, higher plants, and plant and animal remains.

6 . . BACTERIA

a. The higher bacteria are filamentous in character and cause tastes and odors, particularly upon death and sometimes on chemical treatment, particularly chlorination.

b. Among these higher bacteria are four of particular importance in water works.

(1) Beggiatoa, or sulphur bacteria, grow best in the presence of hydrogen sulfide and contain granules of free sulfur in the cells.

. . . Upon death, hydrogen sulfide is generally regenerated during decomposition by other bacteria.

(2) Crenothrix, the iron bacteria, grow profusely in ground water supplies high in iron or manganese content and contain iron or manganese hydrates in a gelatinous sheath around the cells.

. . . Upon decay, offensive odors result. Treatment with chlorine may cause a medicinal odor.

(3) Sphaerotilus natans, (the sewage fungus) grows in stringy profusion in the presence of dissolved organic material, particularly dilute sewage.

. . . It has a very offensive odor when it decays.

7 . . WEEDS

a. Both underwater weeds and reservoir marginal weeds (tules and bullrushes, particularly) can cause nuisances when they die in the autumn.

b. Treatment of water weeds with chemicals may cause odors other than

those of decaying vegetation.

8 . . CHEMICALS

a. Natural occurring

(1) Hydrogen sulfide from sulfur bearing waters

(2) Iron and manganese in high concentrations give a metallic taste to water, slightly bitter, slightly astringent

(3) High concentrations of soda ash or alkalie (above 500 ppm) make water brackish in taste; sodium or calcium chloride in high concentration creates a salty taste.

b. Industrial Wastes

(1) Inorganic chemicals
. . . Acids
. . . Cyanides
. . . Sulfates
. . . Sulfides

(2) Organic chemicals
. . . Aldehydes
. . . Amines
. . . Chlorphenols
. . . Esters
. . . Ethers
. . . Hydrocarbons
. . . Mercaptons
. . . Phenols, cresols, etc.
. . . Pyridine
. . . Skatols
. . . Terpenes

(3) Types of Wastes
. . . Detergents
. . . Drugs and dyes
. . . Fermentation
. . . Food processing
. . . Gas liquors
. . . Insecticides
. . . Petroleum and petrochemicals
. . . Plastics
. . . Pulp and Paper
. . . Tanning
. . . Textiles
. . . Et cetera

c. Odor production in nature

(1) Some odorous chemical compounds are produced by chemical or biological activity in waters containing organic and inorganic wastes.

(2) Decomposition of organic wastes gives rise to many organic compounds which are odorous in nature.

(3) Decomposition in the absence of oxygen will reduce sulfates to hydrogen sulfide.

d. Odor Enhancement

(1) Some odorous chemical compounds are produced by the alteration of a chemical compound in the presence of a water treating chemical.

(2) Phenols in the presence of chlorine form chlorphenols which are far more odorous than the original phenol.

(3) Other wastes such as detergents are unfavorably changed with respect to odor characteristics where chlorination is used.

(4) Nitrogen trichloride may be produced in undesirable and detectable concentrations, if free residual chlorination is practiced on a water high in ammonia content.

TYPICAL acquatic actinomycetes under high power microscope

D . . . Odor Determination

1 . . METHODS AVAILABLE

a. Compounds which cause odors in water are usually present in such low concentrations that they cannot be determined by ordinary laboratory tests.

b. A "carbon filter" technique has been developed at the Robt. A. Taft Sanitary Engineering Center of the U.S.PHS

(1) Five to ten thousand gallons of water are passed through a small activated carbon filter which removes the odorous chemicals.

(2) After drying the carbon it is extracted with chloroform or ether and the chemicals separated into different fractions by differential solubility methods.

(3) This technique is useful in research studies but is not applicable to routine plant observations and control.

c. Determination of odors by the human sense of smell is the only satisfactory method available for regular laboratory control.

(1) Either the quality or the quantity of odor may be determined.

. . . Quality is expressed in terms of well known and easily recognized odors such as fishy, grassy, earthy, musty, geranium, etc.

. . . Quantity is not absolute but is determined as the "threshold odor number", which is the amount of dilution necessary, with odor free water, to reduce the odor to a barely perceptible level when compared to odor free water.

(2) Because of the human factor involved, considerable care must be exercised in the determination.

(3) The threshold odor test can be counted on to distinguish between odor concentrations only 15 per cent apart.

2 . . TECHNIQUES OF ODOR TESTS

a. Quality

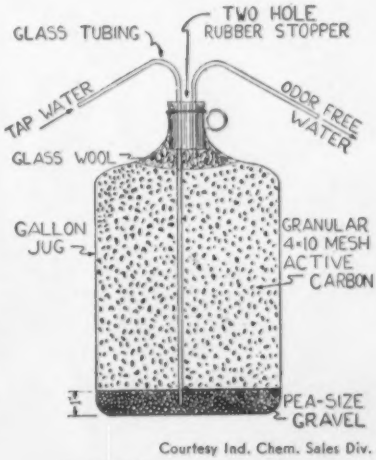
(1) Odor free water and odor free glassware are essential to the test.

(2) Cold odor quality is determined at room temperature by shaking a sample in an Erlenmeyer flask and lightly sniffing the odor.

(3) Hot odor quality is determined by bringing the temperature of a water sample to 58 to 60°C in a covered Erlenmeyer flask and then sniffing after rotating the flask.

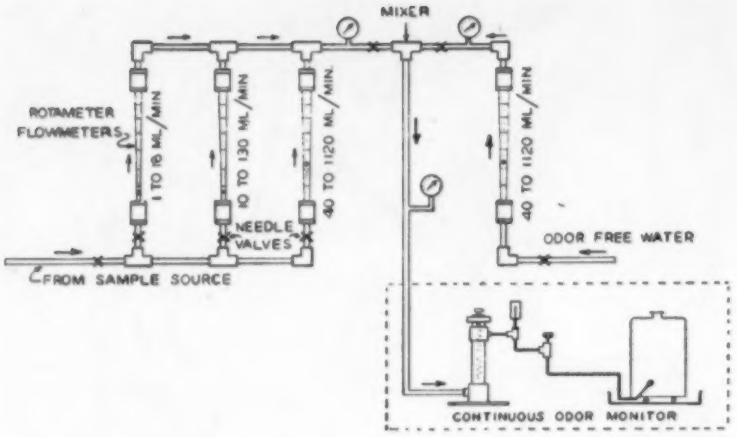
(4) Odor qualities are expressed both as to intensity and type.

. . . Intensity ranges from 0 (no odor detectable) to V (odor of such intensity that the water is absolutely unfit to drink)



Courtesy Ind. Chem. Sales Div.

ODOR-FREE water generator

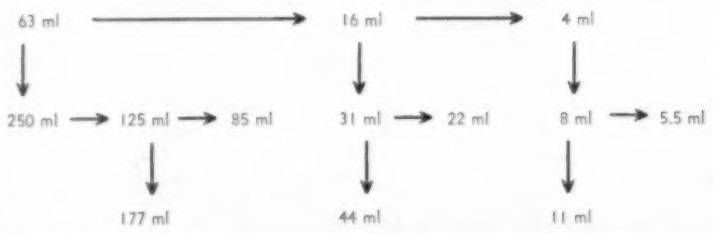


Courtesy Ind. Chem. Sales Div.

CONTINUOUS odor monitor and threshold odor tester

THRESHOLD DILUTION CHART

If odor is present, follow arrow to the right;
If odor is absent, follow arrow downward



. . . Odor quality types are classified as follows:

Abbreviation*	Nature	Examples
A	Aromatic	Camphor, spices
B	Balsamic	Flowery
C	Chemical	Ind. Wastes
D	Disagreeable	Fishy, pig pen, etc.
E	Earthy	Damp earth
G	Grassy	Crushed Grass
M	Musty	Decomposing straw
V	Vegetable	Root vegetables

* Several of these general classifications are subdivided as Bg—geranium; Cc—chlorinous (free chlorine); Cm—medicinal (phenol); Df—fishy; Dp—pig pen; Mm—moldy (damp cellar).

. . . Results are reported on both hot and cold samples.

b. Quantity—Threshold odor number

(1) First essentials are odor free water and odor free glassware and apparatus.

(2) Threshold odor numbers are determined both cold (20° C) and hot (58° to 60° C)

(3) Into a 500 ml wide-mouth Erlenmeyer flask add 250 ml of odor free water as the control. In a second flask add 63 ml of sample to be tasted and 187 ml of odor free water.

(4) Shake each flask and sniff the odor. If an odor is observed in the sample another diluted sample is prepared according to the dilution chart (see accompanying chart) and the odor observed.

(5) When a diluted sample has no odor, the vertical arrow is followed in the chart.

(6) The threshold odor number is the dilution ratio at which the odor is just detectable.

. . . If 16 ml of sample (diluted to 250 ml) has a faint odor but 8 ml (diluted to 250 ml) has no odor then the threshold odor number is approximately 16

. . . Table 1 shows various dilutions and their respective threshold odor numbers.

(7) Complete and standardized directions for the threshold odor test appear on pp. 202-206 in the 10th Ed. of "Standard Methods For The Examination of Water, Sewage and Industrial Wastes."

TABLE 1
Threshold Odor Number

ml of sample diluted to 250 ml	Threshold Odor Number
250	1
177	1.4
125	2
88	2.8
63	4
44	5.6
31	8
22	11
16	16
11	22
8	32
5.5	45
4	64

c. Short-parallel threshold test

(1) When extreme accuracy is involved as in the evaluation of several activated carbons, two-man procedure is used.

(2) By this method, up to five different waters can be compared simultaneously.

(3) One man acts as the diluter and prepares samples and one man acts as the observer; the latter does not know the source of sample or the dilution and is therefore free of psychological influences.

(4) Directions for the short-parallel text complete with dilution chart and examples are given in Chapt. IV of "Taste and Odor Control in Water Purification" published by The Industrial Chemical Sales Div. of W. Va. Pulp and Paper Co.

d. Continuous monitoring of the threshold odor number of a water supply is possible by use of an apparatus developed by H. H. Gerstein in Chicago. It was described in the Jour. AWWA 43:373 (1951).

NEXT LECTURE—Taste and Odor Control—Part 2.

Fluoridation Gets Income Tax Payer in Trouble

A taxpayer bought bottled distilled water in order to avoid drinking the city's fluoridated water. He entered the expenditure for the bottled water on his income tax return as a deductible medical expense.

The Internal Revenue Service took a dim view of this deduction and disallowed it. Probably the Service felt that the cost of the non-fluoridated water was, if anything, an "anti-medical" expense.

THRIFT is the ability to see that things are just as expensive on pay-day as when ones purse is almost empty.

The Consulting Sanitary Engineer's Responsibility To The Municipality

What a municipality can and should expect when a consulting engineer is engaged for water, sewage or refuse projects

by EDMUND B. BESSELIEVRE

Mr. Besselievre is Manager, Industrial Wastes Division, Kaighin & Hughes, Engineers, Toledo, Ohio. His philosophy reflects his many years of experience in the municipal water supply and sewage disposal fields as a sanitary-sales engineer with the Dorr Co.

WHEN A MUNICIPALITY engages a consulting engineer for advice on a sanitary engineering project, be it for water supply, sewerage, sewage treatment, or the handling and disposal of rubbish and garbage, it does so for several excellent reasons, namely:

1. It may be confronted with a problem of securing or exploring an ample present or future supply of water for its people; it may be a problem of developing a sewerage system for a new community or extending an existing one to provide adequate sewage teratment; it may be necessary to develop a logical plan for the collection and disposal of the rubbish and garbage. It could be all three.

2. The municipal engineering department does not have the necessary specialized engineers to properly advise on and execute such projects.

3. The projects may be of a magnitude exceeding the physical capabilities of the available staff and the municipal officials believe it will be more economical to enlist the services of an already staffed, specialized consultant rather than to increase its own staff for one project.

4. The municipal organization feels that a specialized engineer, with a broad experience and who is constantly handling projects of a similar nature, is better qualified to advise on his subject than is its own staff, which probably handles a great hodge-podge of municipal engineering projects.

5. There may be the desire to satisfy divergent political elements by getting outside, unbiased, authoritative advice to quell any criticism.

6. There may be a deadline for completion of a project to satisfy local or state health authorities and it is felt that an outside organization can do the job in less time than the municipal staff.

Regardless of which of these reasons has been the element most responsible for his engagement, a consultant then has the following responsibilities.

Responsibility to the Client

This is the normal ethical responsibility of any professional engineer "to act for his client in professional matters only as a faithful agent or trustee".

Responsibility to the People

This is a moral responsibility to recognize that his client is not a single entity, but is hydra-headed; that each citizen of the municipality is his client behind the scenes, contributing his taxes to the engineer's fee. The responsibility is to solve the problem in a way satisfactory to the majority.

Responsibility to Himself

This is his technical responsibility, which he, as an engineer, subscribes to in his technical societies and the State licensing authorities —to be a "free lance" to recommend to his client the methods, processes, equipment, apparatus, etc., which are in his opinion best suited for the particular project, without regard to his personal preferences.

What the Consultant Should Expect from the Client

Every community, no matter how small, usually has on its staff one or more engineers. These men usually are more conversant with local conditions, utilities, needs, etc., than any outside person could be. It is, therefore, perfectly logical for a consultant engaged to advise on a certain project to expect the cooperation of the local officials in freely and willingly providing records, data, measurements, survey data, or unobstructed access to them. Many of the basic data required in properly studying and evaluating a project are to be found in the records of any municipality. Those that may be lacking are more readily obtained by the local staff than by an outsider. Use of the local staff in obtaining these data eliminates an item of considerable cost in the project.

Population data, water supply needs, volumes of sewage, sewer system details, amounts of garbage, available site data, and many other items essential to the proper solution of a problem are everyday concerns of the staff of a municipality.

Differing from an engagement for the solution of a problem for a single industry, the consultant for a municipality must consider in arriving at his solution all the industries in the town, all of its people and their present and future needs, and all of the local and fringe institutions. The water supply project must usually comprehend all of these factors, for, although in some cases very large water-using industries may provide their own supply, they frequently discharge the used and contaminated water from their processes into the local sewer system. This burden must be realized and cared for.

The estimated future growth of the municipality over a period of years must be foreseen both popu-

lation-wise and industry-wise. To foresee what may happen in, say, 20 years in any given locality may require considerable expert crystal-ball gazing. Nevertheless, it is a necessary consideration. The direction of the growth has a great influence on the type and location of the necessary plants. The placing of a sewage treatment plant close to an area destined for high-class residential use may affect realty values in that area, regardless of the fact that with the methods, equipment and proper design of today such plants can be located in close proximity to residential areas without fear of nuisance. The point must be carefully weighed, because opposition to a plant in a certain locality may, and often has, been sufficient to stall a project.

The residents of a municipality expect to have good water delivered to their homes at low cost; they expect their sewage to be taken away from their homes and handled without any further thought on their part and without nuisance; and they expect their rubbish and garbage to be collected and disposed of, again without nuisance. The council halls of practically every community have reverberated at times with the strenuous complaints of the citizens for better service in one or all of these services. The consultant must bend an open ear to these complaints and in his advice and designs endeavor to remove the causes.

Selection of Methods and Equipment

The sanitary engineering consultant today has at his command a vast wealth of information on tried and proven processes, and on the unproven as well. He has at his command a multitude of manufacturers of equipment, devices and apparatus that all have a part in the make-up of a proper utility. The specialist in any branch of engineering science should be thoroughly familiar with all of these methods, processes, units of equipment, apparatus, etc. If not, he cannot properly advise his client. He may have certain preferences for a given type of treatment or method, or for units of equipment made by a certain manufacturer, with good reason for such preference. He perhaps has used that method or that certain unit of equipment and has found it to be satisfactory for a given project.

But all projects are not the same and no one method or process of water treatment, sewage treatment, or garbage disposal fits every bill. The manufacturers of these items recognize this and the responsible ones will be the first to acknowledge that another method or process is best suited for a given case, if the facts are properly presented to them. No manufacturer wishes to be placed in the position of having furnished equipment to a municipality only to find it unsatisfactory because it was not the right equipment for that project.

The consultant must keep himself in touch with all developments in his field and know the basic factors in the different methods and equipment items so that he may, with the data on the project in hand before him, decide on which method and units of equipment are best suited for that specific case. Having made up his mind on these points he should then call upon the proponents of the chosen method and the manufacturers of the selected equipment to consult with him on the proposed use and to advise him on the proper sizes and types to be used.

This information is insurance for the client. Every manufacturer knows best the advantages and limitations of his product and can best advise the consultant on its proper use. The manufacturers welcome this cooperation and will give freely of their advice and information. There are cases where the equipment of one manufacturer may be the best for several of the treatment phases of a plant, but a unit or two of another manufacturer may seem more suitable for other phases of the same plant. While the consultant should not hesitate to use items made by several manufacturers on the same job, it may be better in some cases, as a guarantee to the municipality of undivided responsibility, to use all units made by one manufacturer, despite a possible slight advantage of one or two units of other manufacturers. Having all units made by one firm eliminates the possibility of one manufacturer dodging his responsibility by placing the blame for trouble on the unit of another firm.

In some cases, where a unit of equipment may be manufactured in the city where the project is located, pressure may be brought to bear to have the city use that local product. There is no objection to this if the unit in question is recognized as a standard, well-made item, and is suitable for the proposed use. In general, however, the consultant should reserve to himself the right to select the equipment, regardless of local pressure or preference. That is what he is paid for.

The consultant has the added responsibility of endeavoring to recommend and design a plant that is not only functionally sound but also conforms architecturally to its environment. He may need to call upon an architect for this phase of the work, as a municipal utility is a public affair and if the people of a community can be made proud of their public works structures, opposition fades away and the slight additional cost for good looks is well advised.

Municipalities and municipal actions are circumscribed and hampered by multitudinous laws which must be taken into account in public projects. The basic intent of these laws is to protect the public interests, but sometimes they handicap the consultant. It may be his considered opinion that a certain process, method or piece of equipment is the best in all respects for a project. But under the law he cannot specify it by name. He must write a specification permitting other manufacturers to bid upon it. Here a municipality should grant its consultant the sole right to recommend the acceptance of the bid which in his opinion gives the city what he intended it to have. Sometimes a city council, under pressure from local interests, will make an award to a low bidder who will furnish equipment not so well suited for the success of the project.

A consultant is usually worthy of his hire and his advice should be taken. Failure to observe the desires of a competent specialist for the sake of a few initial dollars may saddle the municipality with annual operation costs much in excess of any difference in price for a better article.

In a municipal project the consultant must not only consider price. He must consider quality, length of life of a piece of equipment, repairs, replacements, and cost of operation. Municipalities usually pay for their utility works by bond issue, commonly over a period of 20 years. If the equipment finally purchased for a plant wears out or requires replacement before the bonds are retired, this expense must be paid out of normal taxation revenues. Manufacturers of equipment will be glad to furnish record data of the stability and repair cost of their product.

In the average case the municipality does not care what equipment or process is used. It is in-

terested in a plant or utility that will satisfy the requirements at the least cost consistent with good practice. It expects the consultant to have the necessary ability, knowledge and experience, and freedom of action to produce a plan on this basis.

Client Demands and Expectations

Having accepted appointment, the consultant has the following responsibilities to his client:

1. He must, as previously stated, regard himself as the agent of the client community.

2. He must have, and keep, an open mind as to the method of treatment or disposal he will use in the given case.

3. He should not rely solely on any outside influence or source in designing the plants or systems required.

4. He should, by acquaintance with all the recognized processes and methods of treatment, evaluate them individually in respect to the case in hand and decide upon the one or combination of several which best solves the particular problem practically and economically.

5. He should not hesitate to design a plant employing methods, equipment elements, apparatus or devices of different types and of several manufacturers if such a combination in his opinion best serves his client's interests as to economy and practicability.

6. He should study the project carefully and objectively to determine (a) if the client needs an entirely new system or can remodel or extend the present system or plant to better economical advantage; (b) whether the existing facilities are in such condition as to warrant their use and extension, or whether over a term of years a new system or plant would not be better for the ultimate economy of the people; (c) the probable extent of industrial development and what demands such development may put on the system or plants, and decide whether prompt provision should be made in the early stages or left to a later date; (d) if industrial wastes are involved, have factual data on the nature of those which must be taken care of in the plant he proposes, to ascertain if they would inhibit or destroy the processes involved; (e) if much industrial waste is involved, what equitable charge should be made for handling these wastes in the city system; and (f) whether the wastes of several industrial plants might be combined to obtain the benefit of mutual reactions which not only would render the final joint effluent suitable for handling in the municipal system, but also would save each contributing industry money.

7. He should discuss the problems frankly and fully with the local officials, health officials, and those of higher authority having jurisdiction over local watercourses, to arrive, by common and mutually agreeable action, at a basis of treatment that will satisfy all official requirements but at the same time will maintain an economical balance between first cost and operation and the actual needs of the case.

8. He should have the knowledge and experience to be able to determine the most practical and economical methods of treatment or disposal. If he does not have that experience or knowledge, and accepts the appointment, he should then engage a specialist for his staff or for the assignment, who has that ability.

9. If the preferred method of treatment for water or sewage involves the use of chemical compounds as coagulants, precipitants, reagents, etc., he should survey the local field to ascertain what chemical compounds may be obtained cheaply and readily in the local market. He should not restrict his test work to only one or two compounds. Experience in many instances has shown that several different chemical compounds frequently will produce an equal result. If one should be a proprietary compound, obtainable only from one source, the actual amount used in bulk may be less, but the cost may be excessive and the expense and capital outlay required to keep ample supply on hand may amount to a considerable sum. Other commonly obtained chemical compounds may be had which while using a greater amount per unit of work done than the proprietary compound, may have a much lower overall cost. If the common chemicals are produced or obtainable locally, storage facilities may be materially reduced and initial investment cut down.

10. If the consultant does not have laboratory facilities sufficient to enable him to make the necessary determinations on sewage or water which will guide him to a proper solution, he should have this work done, under his own supervision, by established laboratories with competent personnel and equipped with the necessary facilities. There are many of these available (private, college, university) where arrangements may be made on a reasonable basis for the work. The cost is low and the resultant report gives the consultant an independent check not tied into any given method, process or type of equipment.

11. If the method or process of equipment decided upon is covered by patents, the consultant should ascertain the amounts of any royalties or license fees that may be incurred by their use and arrange to have this fee paid directly by his client or include a definite statement in his specifications providing for the bidding contractors to include this fee and to deliver the license directly to the client.

Technical developments in sanitary engineering have trended toward the automatic operation of plant units. This is basically sound, as plant personnel are subject to all of the human frailities and can forget to perform important plant operations. Practically all municipal water and sewage works are subject to municipal or state inspection and periodical records of the results obtained in the plant are required. These results and records can be definitely and conclusively obtained on the dials of modern instruments. In practically all states the laws provide for using only operators trained in certain degrees and certified by license from the state officials to be competent. These men have pride of profession and will maintain their plants in good operating condition at all times if provided with the proper facilities and tools. Automatic operation of many phases will assist them to maintain this perfection.

At the same time, automation should be used in proper ratio to the total plant investment. As the law requires that an attendant be available, it is obviously out of proportion to put automatic devices in service which may, **in toto**, cost as much as the rest of the plant. A big dial-covered panel board is impressive (and expensive), but it does not necessarily assure satisfactory plant results.

The consultant should consider it his duty and privilege to instruct those who will be responsible for the successful operation of the plant. This means not only the chief operator or superintendent, but also the actual operators. Instruction should be given personally.

Complete, easily understandable

manuals should be provided in sufficient number for all concerned with the proper functioning of the plant. The consultant knows, or should know, all of the basic design principles and factors and elements incorporated in his plans and method of operation. But unless he has the ability and the right to impart this information to those responsible for operation, the plant may fail to produce a satisfactory result.

It does not do to present these manuals only to the public works director or the city engineer. Copies should be placed directly into the hands of those who will operate the works. Every manufacturer of a unit of equipment will gladly provide sufficient copies of all operating instructions, lubrication advice, etc., for his product. These also in many cases include instructions for ascertaining the source of troubles and the suggested remedies therefor. These should be incorporated in the Operating Manual by the consultant. Illustrative diagrams conforming to numbered or named units are well worth the trouble of preparation.

It has always been the contention of the writer that every consultant engaged by a municipality to design a public utility which affects the public health should have a clause in his basic contract providing that he will make periodical visits to the plant after commencement of operation to assist in ironing out difficulties and helping the operators to produce perfect results. The consultant knows what he planned to accomplish in the plant and he should be the person most qualified to impart this knowledge to those who will be charged with that accomplishment.

Of the three basic elements of any plant—design, construction, operation—the last is actually the most important. A well-designed, well-constructed plant can be an utter failure if not properly operated. A poorly-designed, well-constructed plant may be made to produce satisfactory results by skilled operation and counsel. And a poorly-constructed plant may also in many instances be made to produce satisfactory results by skilled and strenuous work on the part of interested and able operators.

S. Dakota Waterworks Operator's Short Course

On April 16-18, 1956, the South Dakota Short Course for Waterworks Operators was held at South Dakota State College, Brookings. The photograph above is a portion of the lecturers and short course attendants taking the course in preparation for examinations for voluntary operator certification held the closing day.

Interested in the reason for the facial adornment of several in the photograph, a reply from Prof Garry L. Fisk of S. D. State College Dept. of Civil Engineering (supplier of the photograph) discloses the fact that Sioux Falls is celebrating its 100th year and Mitchell its 75th year. The Cox brothers (back row right) and Messrs Horner, Dahlond and Love (middle row right) are from the Sioux Falls Water Dept. Hansen (middle row third from left)—he with the Paul Bunyon prospector-bush, represents Mitchell.

Short-course lecturers in the photograph are: Wallace T. Miller (rear row, third from right) C. I. Pipe Research Ass'n, Chicago, who spoke on "Maintenance and Operation of Distribution Systems"; John Anderson (middle row, fourth from right) Instructor S. D. State College—"Basic Arithmetic for Water Plant Operators"; Harlan Meyers, City Engineer, Huron, S. D. (first row, third from left)—"Municipal vs. Home Water Softening"; Paul Treite (front row, center) The Flox Co., St. Paul, Minn.—"Water Stabilization"; Jerome Schwab (first row, fourth from right) Fischer & Porter Co., St. Paul, Minn.—"Chlorinating Equipment & Chlorine Handling"; James H. Clark (front row, third from right) Diamond Alkali Co., Painesville, Ohio—"Water Chemistry"; Garry L. Fisk, Ass't. Prof. of Civil Engineering, S. D. State College, and Director of the short course, is on extreme right in the front row.

Plastic Test Bottle For Chlorine Leaks

Pin-points the location

by A. A. HIRSCH

Mr. Hirsch is Water Purification Superintendent in the Department of Water and Sewerage at Shrevesport, La. In this article he presents a useful idea for water and sewage works operators.

THE IMPORTANCE of testing for and locating leaks in gaseous chlorination apparatus, followed by their immediate repair, is well appreciated by all water and sewage plant operators. Devices used for spotting leaks have been, until recently, cotton swabs moistened with ammonium hydroxide or a bottle containing this material held with mouth open close to the suspected spots. The tell-tale white fumes of ammonium chloride pin-points the leak.

New Type Container

A newer container for holding the ammonia water is a polyethylene blow-bottle having a perforated top. The bottle is only partly filled with liquid so that pressure on the flexible sides ejects some ammonia-laden fumes in the vicinity of the leak. Since ammonia tends to escape through the orifice on standing the liquid loses strength and causes a slight odor near by.

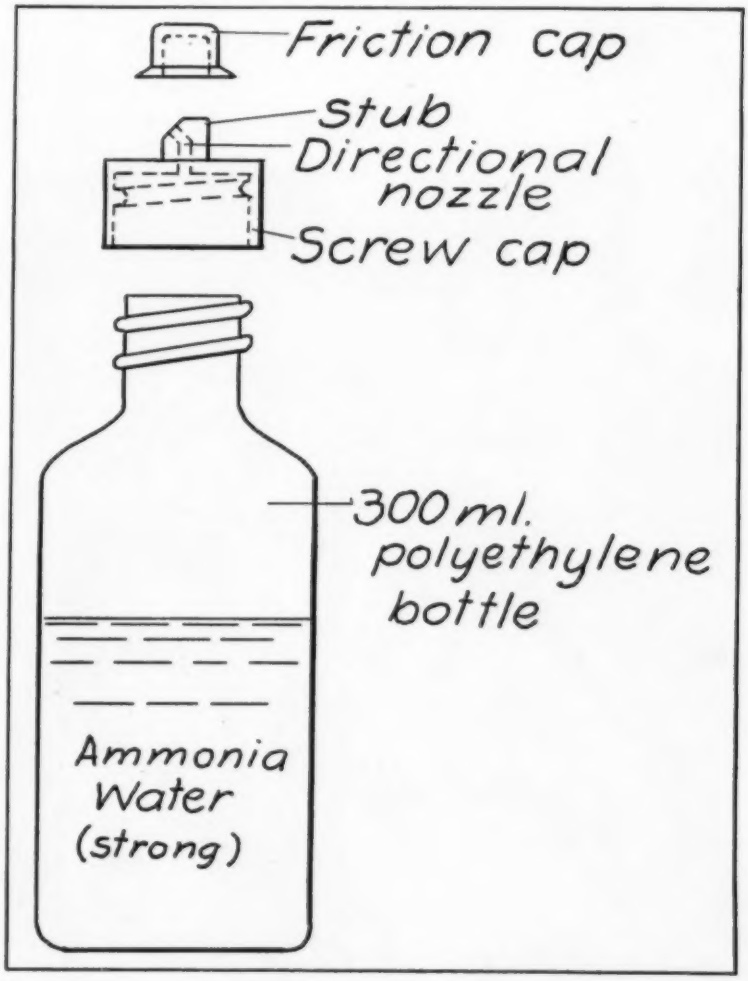
Properly protected, the blow bottle is an ideal device for this purpose; a recommended type of polyethylene bottle is shown in Figure 1. Its capacity is about 300 ml and is two-thirds filled with ammonia. The lid consists of two parts, a screw cap surmounted with a stub through which a hole is offsetted, and a friction cover for this cap. The type illustrated, originally designed as a dropping bottle, was manufactured by the Plax Corporation, 221 N. LaSalle Street, Chicago 1, Ill.

The regular size of mouth permits filling the bottle easily and the cover over the nozzle retains the strength of the ammonia almost indefinitely. Counterboring the nozzle passage as indicated at a 45° angle allows the vapor to be jetted in a convenient direction, and keep the liquid in the bottom for locations where the bottle would otherwise have to be tilted.

Other Modifications

Readily available and simpler modifications, but lacking some of these advantages, may be made from such articles as plastic bottles for ketchup or from a plain, polyethylene bottle with a 1/64 inch hole drilled through the cap. An ordinary steel pin can plug the hole.

Plastic pocket flasks have been considered on account of their ease in carrying and positioning on a shelf, but they do not squeeze as much vapor volume as do the round bottles of the same size.



POLYETHYLENE blow bottle

Repair and Reconditioning of Lubricated Plug Valves

Often returns them to their peak efficiency

by PAUL A. MANOR
Chief Engineer
Barberton Division
Rockwell Manufacturing Co.

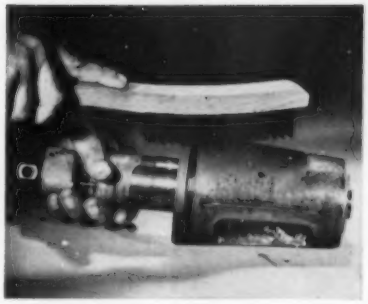
AS IN MANY chemical or processing plants, valves in water treatment and sewage disposal installations can frequently determine the success or failure of an operation. They deserve the same type of careful service as more spectacular types of equipment such as chlorinators, filters, and aerators.

From an economic standpoint, spending money to repair and recondition ancient valves would seem reasonable. Whether a certain valve justifies repair is an individual matter, however, and should be decided by comparing the estimated cost of repair with the cost of buying a new valve.

Even after years of service, lubricated plug valves can often be returned to peak efficiency simply through cleaning, inspection, and reassembly with new packing and gaskets. The purpose of this article is to present a basic guide for reconditioning or repairing these valves.

Cleaning and Examination

The valves should be cleaned as much as possible before taking them apart. After completely disassembling the valve, use any solvent or alkaline solution to clean the parts. Apply wire brushing or abrasive blasting to clean corroded areas. Tapered seats of both body and plug should be carefully examined for corrosion, pitting, scoring, galling, or erosion. For plugs having integral shanks, check the diameter of the machined shank. Also, examine the shoulder adjacent to the plug shank for corrosion or erosion.



WIRE BRUSHING to remove deposits from corroded areas; abrasive blasting might also be used

Repairing the valve depends on how seriously the seating surfaces of both plug and body are scarred. The following are some typical cases:

Case 1. Corrosion or scoring is very shallow. Here, the valve can be salvaged by relapping the plug in the body. Machining the seating surfaces of either the body or plug is unnecessary. For integral-shank plugs, however, the shank diameter and adjacent shoulder must be resurfaced by grinding before relapping.

Case 2. Corrosion, galling, or scoring is moderately deep. Remachining the tapered seating surface in the body is necessary. This usually requires an oversize plug to match the oversizing of the taper bore.

Case 3. Severe corrosion, erosion, galling, or deep scoring. Before machining the valve body bore, the worn areas in the body must be rebuilt to restore the tapered seating surface. Rebuilding may be done by any standard welding or brazing process.

LUBRICATING 12-inch valves at pressure-reducing station, Santa Barbara, Calif.

Valve plugs are individually fitted and lapped to valve bodies by the manufacturer. Consequently, replacement plugs are furnished in oversize dimensions with a semi-finished taper. Excess metal is allowed, therefore, for fitting the plug to rebored valve bodies. Most valve bodies have extra metal at the tapered section; this permits one or more reboring operations without reducing the body's wall thickness below allowable limits.

CHECKING DEPTH of lubricant groove is one step in valve examination

CHECKING TAPER with feeler stock. Valve bodies can be machined

Remachining Valve Bodies

Use either an engine lathe or a vertical boring mill to remachine valve bodies. Obtain a taper attachment or ram for the lathe or mill, capable of producing a taper angle of 4½° from the centerline of the valve body.

To be on the safe side, make a trial cut on scrap to check both the accuracy of the taper angle and the overall setup. Then make the initial cuts on the valve body to remove all blemishes. Take the final, finish cut very lightly and with a fine feed in order to obtain a clean, smooth, true taper bore.

Accurate work cannot be obtained unless the spindle, tool carriage, and machine ways are in good condition and are properly adjusted to avoid "lash." These precautions are particularly important when finish-boring plug valve bodies because of the interrupted cut when the tool passes over port openings.

After machining the bore, check the lubricant grooves or ducts on the valve body. If any are shallow or missing, they should be deepened or reproduced by either chipping, machining, or grinding. Similarly, valve bodies which require rebuilding of worn areas prior to machining must have the lubricant grooves or ducts remachined.

Machining Plugs to Fit Valves

For valves consisting of:

1. Iron alloys and bronze—

Oversize plugs are shipped centered and finish-machined (except for the taper section).

Place the plug between centers in a lathe. Adjust the taper attachment on the lathe 4½° from the centerline of the plug.

First, take caliper-and-scale dimensions from the valve body to machine the taper on the plug. Don't machine too far. Leave enough metal for final matching of taper and diameter.

After machining the plug so that it sinks partially into the body seat, check the taper angle by placing strips of "feeler stock" between the plug and body near both ends of the taper. If necessary, make light trial cuts. Adjust the lathe taper attachment after each cut until an exact fit is obtained.

After the taper is exactly matched, make additional light cuts until the plug enters the body with the plug shoulder **below** the body gasket seat a distance about equal to the minimum dimension allowed by the manufacturer. Thus, for the final lapping operation, the plug can shrink slightly further while still remaining within its allowable dimensions.

2. Steel—

Plugs for steel valves require a hardening treatment between ma-

APPLYING lapping compound to bearing surface of plug

LAPPING valve by hand, final step in making close fit

CHECKING accuracy of fit with valve which has been blued

chining and lapping operations to prevent galling and sizing in the valve body. Steel replacement plugs are furnished soft so that a taper can be easily obtained to fit rebored bodies. Don't try to rebuild steel valve bodies unless heat-treating and grinding equipment is available for hardening and shaping the plugs.

Turn the plug to fit the body bore, as previously described for semi-steel valves. About 0.020 to 0.040 in. of additional metal must be left on the plug taper to permit grinding after heat treatment. Heat, quench, and draw the plug to obtain a medium hardness on the taper surface. Plugs with integral shanks should be quenched on end to minimize warping.

After hardening, grind the plugs between centers to finish them. The procedure for fitting the taper in final position in the valve body is the same as for iron alloys.

Lapping

The final step in obtaining a close fit between valve body and plug is to lapp the respective bearing surfaces with an abrasive. Lapping cannot be used to correct mistakes in previous machine work. Excessive lapping may cause the plug to fit too deeply in the valve body. Only enough lapping to take out tool and grinding marks and to produce a smooth finish on the taper surface should be necessary.

Before starting to lapp, use either a file or emory cloth to smooth all sharp edges on both body and plug.

Valves may be lapped either by hand or with a drill press. If a drill press is used, secure the valve body to the base and rotate the plug through a floating attachment connected to the spindle.

For a lapping compound, use 200-grit aluminum oxide for steel valves and 200-grit silicon carbide for iron valves. A non-lubricating oil emulsion should be used to keep the compound in suspension.

When lapping, lift the plug about ¼ to ½ in. out of the valve body after each four or five revolutions. Sufficient space should be provided between plug and body to permit the lapping compound to spread evenly.

Continue lapping until all machining marks disappear and the surface shows a uniform "matt" finish. Rotation of the plug in the body should now show an even metal-to-metal contact, without excessive bright or dark areas. The accuracy of the fit can be checked by blueing the plug into the body and rotating it one or two turns under light pressure. Any mismatching, off-taper, or out-of-roundness will show clearly when the plug is removed and examined.

The same requirements as indicated for lapping with a drill press hold true for hand lapping. In the latter case, however, the plug is usually oscillated four or five times between each lifting of the plug out of the body.

After the lapping is completed, the depth of the plug in the body should be checked against the manufacturer's specifications.

"What Plant is This?"

We have had many inquiries concerning the identity of the water and sewage plants built to serve a large Florida Housing Development, that was used on the front cover of our February issue. Consequently, we have decided to repeat the picture here and identify the plants. The cover picture caption was incomplete in that no reference was made to the lead article on "Developments in Sewage and Industrial Wastes in 1955", in which reference was made to the problem of water and sewerage facilities for housing developments and new subdivisions, and how this problem is being solved.

The February cover picture (left) was used to illustrate what is being done in Florida, where subdivisions are being provided with small independent water and sewage plants, operated by qualified operators as a privately owned utility after the completion of the housing development, and usually at a profit. The sewage treatment plant is in the foreground and the water treatment plant is across the man-made lagoon.

These plants are serving the new town of Carol City—one of Miami's king-size subdivisions—which will probably be Florida's ninth city in population when completed. The sewage treatment plant is of the activated sludge type, equipped with the improved Simplex Type Yeoman's "Hi-Cone" Mechanical surface Aerators and Yeoman's "Spiraflo" clarifiers for primary and final setting.

On the relative efficiency of the improved Simplex high intensity aerators at Manchester, England, John Finch of Slough, England, in one of his "Reports from Abroad" records the high efficiency of this type of aeration units at the Manchester plant —see page 89, Feb. 1956, W&SW.

Do You Have A Sewer Problem?

An open letter from one superintendent to another

Dear Bill:

Last time we got together, you asked me about my sewer maintenance program, of which, at the time, I didn't really have any. So I came home and did some tall thinking about our whole sewer system and the problems involved. I went into our files an dug out notes and records in past performances, maintenance and problems. From that study, I developed a list of categories of sewer problems. Then I tried to do some planning how to handle these things in the future.

This is the way I set up the list.

Combined Sewers	Nuisances
Storm Flow	Tree Roots
Street Sanding	Stranding
Catch Basins	Odors
Complaints	
Noisy Manhole Covers	Cleaning and Maintenance
Flooded Basements	Inspection and Regulations

Combined Sewers

I'm no different than most men in our field, I'd prefer to have my storm sewers separate from the sanitary system, *but* back in the dead days of long ago they didn't build them that way. So, I have my share of problems due to combined sewers.

Naturally, one of the worst is surcharging. It happens every time we have a really heavy downpour. Of course, it's to be expected since the sewers were built long before the development of many streets and many homes. Add to that, the fact that many roof drains were connected to the sewers before we had adequate inspection and you can see why our sewers run full. Incidentally, the boys at the treatment works don't like all that storm water either, because it plays hob with their operations as well as bringing in extra grit and fine sand and all kinds of trash.

That sand comes from street sanding operations in the winter season, and believe me there are tons of it. It fills the catch basins, settles out in the flat stretches of sewers and as I said eventually reaches the treatment works where the course stuff settles out as grit. The fine stuff settles out in the clarifiers and then in the bottom of the digesters, where it builds up a hard deposit of considerable depth, requiring dewatering and cleaning.

Of course, the sand and trash accumulation in the catch basins requires pretty regular cleaning and we have now set up a routine of catch basin cleaning three times a year, early spring, mid summer, and late fall after the leaves have fallen. It costs us about 60 cents apiece to clean small receivers and about $1.70 for the large box type.

Nuisances & Complaints

It was apparent from the records that the three worst nuisances have been tree roots, standing of solids, (besides grit,) and odors. In many instances these three problems are definitely related. Stranding of sewage solids is sometimes due to flat inverts, and sometimes to obstructions by tree roots and stranding usually results in odors.

Odors usually cause complaints from people in the neighborhood. Besides this complaint, the most common ones are noisy manholes and flooded basements. Noisy manholes are usually fairly easily fixed but flooded basements are another thing. Sometimes they are caused by surcharging, sometimes because of tree roots, either in the lateral sewer or in the sewer on the private property.

Maintenance & Cleaning

From this study of past records, we developed a sewer maintenance program. To begin with we made a large map of the sewer system and then each time there was a complaint we stuck a colored pin in the map at that point. We used different colored pins, red for flooded basements, brown for odors, black for manholes noise, green for tree roots when they were found, and blue for surcharging. By plotting previous complaints from the records and all new ones, it didn't take long for us to have a good indication of where the trouble spots were.

Next we set up a routine cleaning schedule for catch basins as I said. That helped a great deal. Then we instituted an inspection system and schedule. The inspection system included new property lines as well as old and actual inspection of the truck sewers at every manhole. From these latter inspections we were able to determine the frequency with which different sewers should be cleaned. It didn't take much more than a year to pretty well have a complete schedule worked out for cleaning the entire system.

Local nuisance problems which recur in specific areas receive regular attention. Then, too, we service each individual complaint promptly as it is received. Incidentally, as a matter of public relations we had the newspaper do a story on our new sewer maintenance system and in it we ask all residents to please call in complaints promptly so we could handle the situation. The complaints fell off after the story, partly no doubt because we were reducing the causes, and partly because the people felt more kindly toward the sewer department.

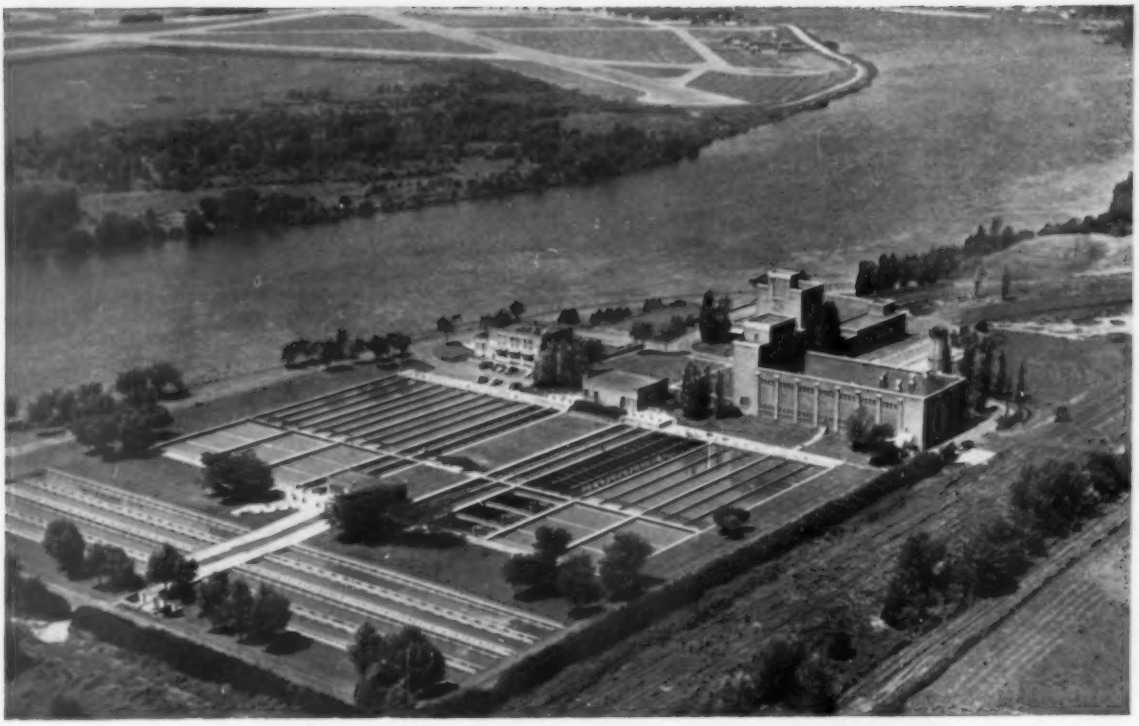
Among the equipment items we use in sewer cleaning are flushers, drag buckets, orange peel buckets, eductors, winches, flexible rods, and so forth. We use power equipment wherever we can and have purchased practically a completely new set of machines since we put sewer maintenance and cleaning on a regular schedule. For root cutting we use motorized cutters on flexible cable.

It is not within our province to clean roots out of house connections, but whenever we run into an area where roots exist in our sewers, we notify all the property owners tributary to that sewer and advise them that if they have any indication of poorly functioning sewers, they should have their connections checked for roots and cleaned if necessary.

We find that the average cost of cleaning sewers is now about 15 cents a lineal foot. Before we instituted our regular cleaning program and obtained our new equipment, we figured it cost us about 25 cents a foot. And we didn't have clean sewers much of the time.

I'm so pleased with the results we have obtained under this new program, that I wonder now why I didn't do it before. Thanks for making me think about the problem.

Yours, Jack



MINNEAPOLIS—ST. PAUL Sewage Treatment Works on the Mississippi River

Vacuum Filtration of Raw Sludge

Practices and experiences at Minneapolis-St. Paul

by KERWIN L. MICK and SCOTT E. LINSLEY

Messrs. Mick and Linsley are respectively Chief Engineer and Superintendent and Assistant Engineer of the Minneapolis-St. Paul Sanitary District. In this article they discuss the economic evolution of vacuum sludge filtration in their plant.

ONE OF THE MOST expensive operations in the treatment process for sewage plants located in densely populated metropolitan areas is that of sludge disposal. Of the plants requiring sludge dewatering, the vacuum filtration operation is costly, demands a great deal of close control, and therefore is worthy of considerable attention.

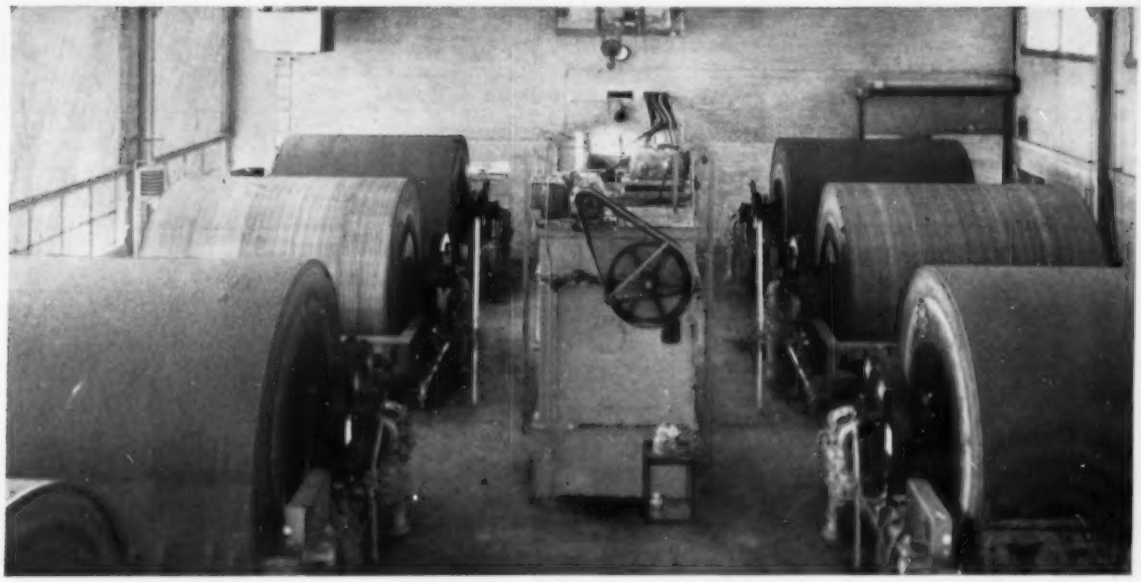
A glance at Table 1 will give an insight into the relative magnitude and importance of expenditures for vacuum filtration compared to other departments at the Minneapolis-Saint Paul sewage treatment works.

Operating Problems

In addition to economic factors, there are also many other operating problems of which system stability, uniformity of sludge cake moisture, maintenance, and heat balance are of primary importance. The system of sludge disposal employed at Minneapolis-Saint Paul is a continuous 24-hour a day process employing incineration; therefore, cake moisture control assumes added importance due to the evaporative load besides the combustive load applied to the system.

Control of moisture of the sludge cake in the vacuum filtration process is effected primarily by adjusting the following factors:[1]

1. Filter drum speed (drying time, cake thickness, and agitation).
2. Washing rates (frequency, duration, and fluids applied).
3. Chemicals used for sludge conditioning.
4. Sludge levels in the filter basins and mechanical arrangement of piping, valves, bridges, and drainage structures (baffling for controlling run-back, blow-back, etc.).
5. Filter media (porosity and rate of blinding).



VACCUM filter room with eight filters

The Minneapolis-Saint Paul Sanitary District sewage treatment plant vacuum filters raw sludge. The sludge is pumped from each of six settling tanks once every eight hours to a pair of concentration tanks where it is held between 24 and 48 hours and approximately ¼ of its volume pumped back to the settling tanks as supernatant liquor. After concentrating the sludge, it is fed by gravity to a conditioning tank and then to a battery of eight 11½ ft diameter x 14 ft long Oliver vacuum filters.

For ten years prior to 1955, the solids in the sludge cake averaged 31.6 per cent and a considerable excess of heat existed in the cake over the requirements necessary to evaporate all of the water in the cake, effect complete combustion, and raise the temperature of all gases generated high enough to eliminate offensive odors.

The dry solids in the sludge cake for 1955 averaged 27.3 per cent, the decrease being due principally[1] to changing the filter media from a napped 8-oz. Canton flannel to a 32 x 32 mesh Saran cloth screen woven from a 10 mil monofilament saran plastic yarn and[2] to a drastic reduction in the amount or at times complete elimination of chemicals used for sludge conditioning. This change in solids content resulted in a reduction of the amount of excess heat available for evaporation and draft purposes. Even with this change, oil is still rarely needed as an aid to combustion and normally is only necessary when shutting down an incinerator or starting one up (a two to three day process).

Improvements in Conditioning

For many years, considerable attention has been devoted to the mechanics of sludge conditioning, distribution, mixing, agitation, proportioning, hydrogen-ion concentration, and the like, with steady improvement in efficiency. Notable changes effecting substantial improvements in sludge conditioning were the following:

1. The addition of a lime slurry riffle board or distributing board and screen in the conditioning tank.
2. The provision of low pressure air agitation at the bottom of the tank thru a series of small holes connected in groups to separate air headers.
3. Internal baffling to improve mixing and avoid short-circuiting or segregation.
4. Piping, valve, vent, and conditioning tank revisions providing for feeding eight vacuum filters from one, two, or either of two bucket elevators and one conditioning tank.
5. The addition of equipment to utilize the carbide lime slurry waste product from Twin Cities acetylene generators.

In the original design of the vacuum filters, it was necessary to shut a filter down before it could be washed. Washing was accomplished by a set of sprays attached to a piping header on the backside of the filter drum (the side away from the discharge side). In 1955 the Sanitary District staff developed a new method of washing wherein the sprays were moved to the front side of the filter immediately under the take-off plate. A wash-water trough was installed immediately under the spray assembly and it is now possible to wash all filters while they are operating, resulting in greater efficiency both as

TABLE I

Account No.	Department	% of Total Cost *
1	Administration	10.1
2	Supervision and Engineering	10.9
3	Laboratory	5.7
4 & 5	Grit and Screenings Removal and Disposal	8.5
9 & 10	Sedimentation and Scum Disposal	10.7
13	Vacuum Filtration of Sludge	25.9
14	Sludge Cake Incineration and Disposal of Ash	14.6
—	All Others	13.6
	Total	100.0

*Based upon MSSD Annual Reports.

TABLE 2

Some Biennial Comparative Costs of Vacuum Filtration Years 1954 and 1955

Vacuum Filtration Costs, Year 1954

Iron Coagulant	$ 37,098.61
Lime	17,899.94
100 Filter cloths incl. wire @ $31.89+$19.28	5,117.00
8 Filter cloths incl. wire @ $87.91+$19.28	857.52
Power and Light	18,179.63
Acid to cloths, 339 carboys @ $5.56	1,884.84
Maintenance	29,775.84
*Attendance (Salaries and Wages	74,337.28
(Miscellaneous	954.31
Total	$186,104.97

Total tons dry sewage solids filtered — 40,909
Total cost per dry ton = $4.55

Unit Costs Per Dry Ton

		% of Total
Iron coagulant	$0.91	20 } 30
Lime	0.44	10 }
Filter Cloths + Wire + (L&M)	0.15	3
Elec. Power & Light	0.44	10
Acid to Cloths	0.05	1
Maintenance	0.72	16
Attendance (Sal. & Wages	1.82	40
(Misc.	0.02	—
	$4.55	100%

Vacuum Filtration Costs, Year 1955

Iron Coagulant	$ 14,759.76
Lime	14,034.60
6 Saran cloths, incl. wire @ $90.25 + $20.32	663.42
Power and Light	18,107.33
Acid to cloths, 97 carboys @ $5.23	507.31
Acid to pipes, woodwork, etc. 131 carboys @ $5.23	685.13
Maintenance	41,066.81**
*Attendance (Salaries and Wages	79,181.53
(Miscellaneous	2,261.09
Total	$171,266.98

Total tons dry sewage solids filtered — 44,126
Total cost per dry ton = $3.87

Unit Costs Per Dry Ton

		% of Total
Iron Coagulant	$0.33	9 } 17
Lime	0.32	8 }
Filter Cloths + Wire + (L&M)	0.02	1
Elec. Power & Light	0.41	10
Acid to cloths	0.01 }	1
Acid to Pipes	0.01 }	
Maintenance	0.93	24
Attendance Sal. & Wages	1.79	45
(Misc.	0.05	1
	$3.87	100%

*Note: Cost figures are based on MSSD Annual Financial Reports.
**This figure includes 100% internal piping and replacement in six filters, which would normally depreciate about 1/17 per year

to equipment utilization as well as economy of treatment.

Filter Media

Several varieties of filter media were tested ranging through the various weights of napped and non-napped Canton flannels to poplin and cheesecloth, with always a return to the 8-oz. napped Canton flannel. In late 1954, Walter M. Kunsch, Supt., Sewage Treatment, Waterbury, Conn. courteously made available technical data on his experimentation and research utilizing polyethylene and Saran filter medias. These data[2] indicated the probable feasibility and practicability of using the new Saran filter media at Minneapolis-Saint Paul. The results, to say the least, were spectacular.

Table 2 shows some comparative costs before and after the change to the new filter media. In 1954, 8-oz. Canton flannel was used until November 4 when conversion was made to Saran. That date marked the beginning of the learning period when certain old operating practices had to be discarded and new ones established. In 1955, the new filter media was used the entire year.

There are several basic operating changes that have made these results possible. For example:

1. The life of an 8-oz. Canton flannel filter cloth averaged 465 hours for the past five years before it was blinded so badly that it became useless. Vacuum filter speeds ranged from 7 to 14 revolutions per hour for these cloths. The average life of the Saran cloths or screens used in 1955 before discard was 5,743 hours. Further, this is not a very representative figure since some of these cloths still had adequate porosity but failed mechanically. At this writing, two cloths have been in service in excess of 10,000 hours and are still being used.

TABLE 3

Vacuum Filtration Chemical Cost Summary—1955

	Unit Cost Per Ton of Solids Filtered				Total For Month and Year		
	Dry Basis			Volatile Basis	Filtered Solids	Chemical Cost	
1955	Iron Coag.	Lime	Total	Total	Dry Tons	Actual	*Deviation From Mean
January	$0.09	$0.25	$0.34	$0.45	3,550	$ 1,210	$ —3,050
February	0.01	0.02	0.03	0.04	3,219	110	—4,070
March	0.06	0.05	0.11	0.16	3,590	400	—3,860
April	0.19	0.19	0.38	0.55	1,845	710	—2,130
May	0.16	0.28	0.44	0.60	4,021	1,790	—3,970
June	0.37	0.34	0.71	1.04	4,662	3,320	—2,710
July	0.97	0.50	1.47	2.26	3,919	5,760	—1,180
August	0.77	0.59	1.36	1.95	3,868	5,280	— 420
September	1.14	0.64	1.78	2.43	3,612	6,430	+ 480
October	0.43	0.44	0.87	1.15	3,991	3,460	—2,100
November	0.11	0.33	0.44	0.57	3,787	1,650	—2,820
December	0.04	0.20	0.24	0.31	4,062	950	—4,290
TOTAL					44,126	$31,070	$—30,120
Inventory & Pricing Correction						2,270	2,270
YEARLY AV.	$0.33	$0.32	$0.65	$0.90		$28,800	$—32,390

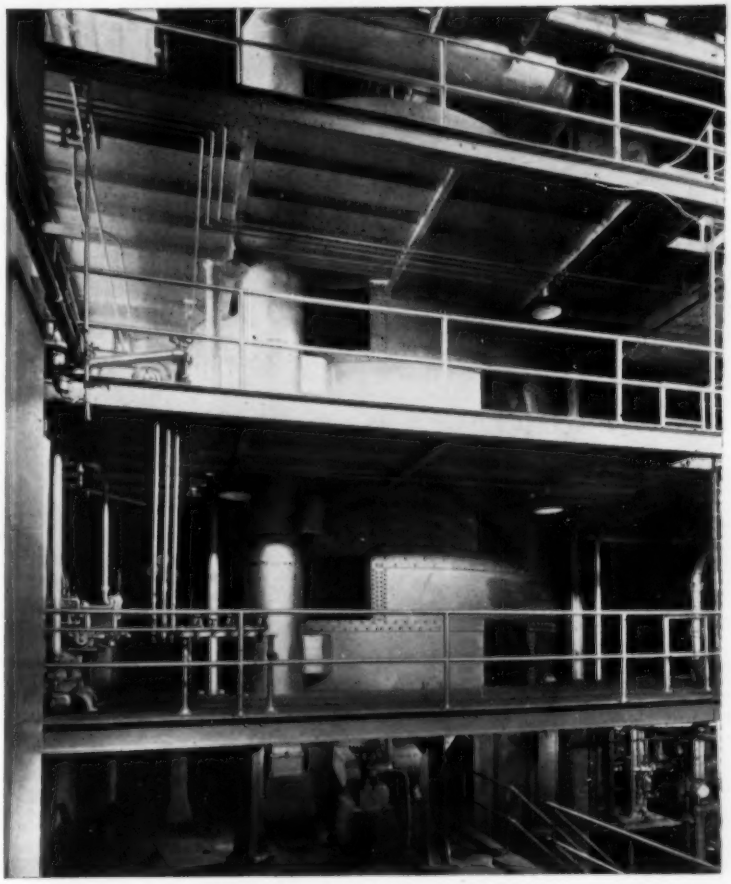
*Deviation from expected costs based upon a 5-year average % Fe and % CaO on a volatile solids basis for corresponding months (1950-1954)—See Table IV.

2. Another change is the drastic reduction in the amount of iron coagulant required as well as the substantial reduction in the lime requirement, over $32,000 less than anticipated. Note Tables 3 and 4. The primary consideration in these two factors is the operating ability to remove the cake from the filter drums, and secondarily, to control the moisture to the point necessary for economic incineration conditions.

3. For more than ten months it was also possible to reduce the filter washing rate from once every hour to once every two hours, thereby effecting additional economies.

The rather poor savings indicated for August and the higher cost for September is partially due to leaky internal vacuum filter piping on six of the old drums (following 17 years of operation). After replacement, vacuums rose to normal values and only one vacuum pump was required

Insofar as over-all plant operation is concerned, no deleterious effects have been observed. Efficiency of removal has been maintained. The suspended solids in the sludge filtrate averaged 110 ppm for the five-year period 1949-53, and 2,000 ppm for 1955; however, the total solids in the sludge filtrate averaged 3,500 ppm and 4,850 ppm for the same respective periods. Further, settleable solids are removed and sent back thru the sludge disposal process a second time and if any are left, they continue to recycle.



MULTIPLE hearth Nichols incinerator

Future Investigations

As to the future, there are several avenues of investigation which seem worthy of the effort:

a. Since filter drum speed is a major factor in sludge cake moisture control, studies will be made toward determining the optimum economical drum size and operating speed ranges suitable for use with other existing equipment, plant space, and capacity available. In addition, these factors will be determined for a new or original installation as well.

b. Vacuum filter design and construction as to run-back, blow-back, drainage, and washing will be investigated since the units no longer function wholly as originally intended and certain economic improvements reducing maintenance and attendance as well as increasing capacity can probably be effected.

c. There are at least two radically different vacuum filters now being used in the sludge vacuum filtration field, namely, the Komline-Sanderson coilspring filter and the Eimco Roto-Belt filter employing a woven metal filter media. So far, there are insufficient technical data available as to sludge cake moisture content to be expected in a continuous 24-hour day, year-round operation, and the economic merits of the investments involved to provide a sludge cake of the required moisture content. These two types of units should also provide an interesting and practical avenue of investigation and approach to the sludge dewatering problem.

TABLE 4

Chemicals Used (Volatile Solids Basis)

Period	1955		5-Year Average 1950-1954	
Month	% Fe	% CaO	% Fe	% CaO
January	0.16	2.73	1.49	3.63
February	0.01	0.28	1.46	3.49
March	0.11	0.58	1.62	3.19
April	0.37	1.66	1.50	3.20
May	0.27	2.18	1.54	3.90
June	0.67	3.99	1.63	4.65
July	1.88	5.96	2.51	5.66
August	1.43	6.20	1.79	5.29
September	1.81	6.02	1.77	5.02
October	0.71	4.40	1.55	4.60
November	0.18	3.17	1.26	4.11
December	0.06	1.58	1.26	3.94
Avg. for Year	0.65	3.33	1.58	4.29

References:

(1) Note the research on this subject by A. J. Beck, et al, page 689, Vol. 27, No. 6, June 1955, Sewage and Industrial Wastes.

(2) Private letters from Walter M. Kunsch, Superintetndent, Waterbury, Conn. Sewage Treatment Plant, July and August, 1954.

AERO-ACCELATOR® installation for phenolic waste treatment, General Petroleum Co., Ferndale, Wash.

New Equipment for The Activated Sludge Process

Device designed for efficient utilization of treatment method

by A. A. KALINSKE and A. W. BUSCH

Mr. Kalinske is Director of Research and Development of Infilco, Inc., Tucson, Ariz. This paper describes a new proprietary device and presents data on its performance in activated sludge treatment.

Mr. Busch is Associate Professor of Sanitary Engineering, Rice Institute, Houston, Texas.

THE TREATMENT OF waste waters containing organic material of putrescible nature, i.e. subject to microbiological degradation, is a problem pressing heavily on the Sanitary Engineer. As public awareness of the ill effect of stream pollution grows, pressure for treatment increases. Simultaneously, industrial and municipal officials, faced with heavy construction costs, call for reduced capital outlay through more efficient treatment processes. In addition to the cost of structures, land area available is often an industrial limitation. Again, more efficient treatment means a smaller plant.

In searching for more effective methods and processes, many sanitary engineers have recently emphasized study of the mechanism of microbiological oxidation—the reactions involved, time required, optimum nutrient levels, biochemistry of the ideal environment. In short, the kinetics of biological activity in waste treatment as typified by activated sludge, have been delineated in great detail. As information concerning the complex reactions involved became available, process and equipment designers began translating this into practice.

This paper presents the results attainable in an environment designed for optimum activity of micro-organisms as indicated by the kinetic principles involved. As background, the growth of bacterial cultures and the mechanism of B.O.D. removal are reviewed.

Growth of Bacterial Populations

To briefly summarize the typical growth curve for bacterial populations, several distinct phases may be defined:

1. A lag phase producing little or no increase in bacterial numbers,
2. A logarithmic phase characterized by multiplication according

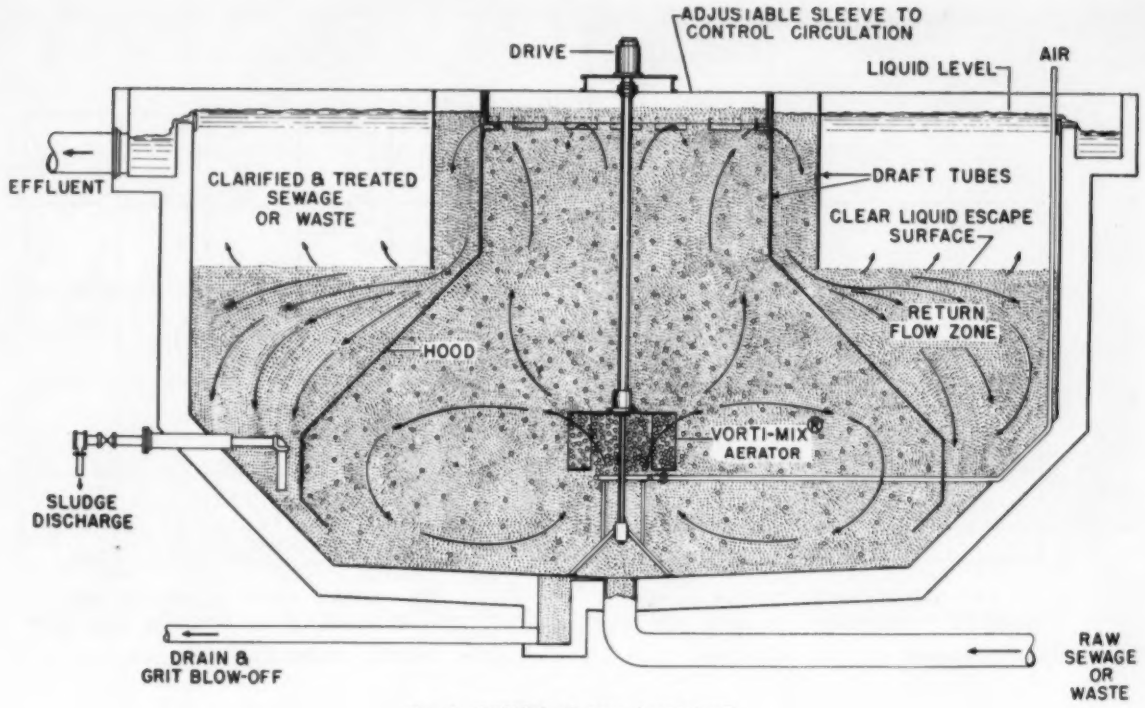


Fig. 1—DESIGN of Aero-Accelator®

to geometric progression,

3. A stationary or resting phase during which the peak population is maintained and
4. A declining phase producing gradually diminishing bacterial numbers.

Transitions between these phases are sometimes included as additional stages.

Mechanism of B. O. D. Removal

Organic matter in waste waters may be classified as present in the dissolved or the colloidal and suspended state. The removal of soluble material in a continuous system containing organisms in an active state of growth is generally rapid. Such matter is more readily available than suspended or colloidal substances which are adsorbed onto the mass of organisms and are consumed somewhat more slowly, depending upon the enzymatic action required. Several excellent summaries of the detailed reactions involved in the biological oxidation of organic material are available in the current literature.[1] [2] [3]

Design Considerations

Of prime importance to the designer is the fact that efficient aerobic bacterial activity requires the continuous presence of oxygen—usually introduced by compressed air dispersion of one type or another. It is generally agreed that any anaerobic period in excess of 30 minutes is detrimental to the activated sludge process. As the anaerobic period is extended, the time required for recovery of the organisms, following resestablishment of aerobic conditions, is prolonged up to the point of process failure due to death of the sludge.

Another requirement for steady state high level activity is a system for continuous loading of the organisms. The rate of loading will vary with the inflowing waste characteristics, of course, but the application itself should be continuous. When the sludge is settled in a final clarifier and returned to the aeration basin after varying anaerobic periods, it is impossible to provide a steady state loading equilibrium. Pasveer, [4] [5], has definitely shown that under proper conditions the maximum rate of oxidation of organic by activated sludge has as yet not even been approached by past designs of equipment and practices of the process.

Theoretically the bacterial population required to remove a given load of B.O.D. in a fixed time may vary within wide limits. The one extreme is a young, actively growing population of relatively few numbers whose metabolism is keyed almost entirely to synthesis of new organisms since the base food demand is low. At the other extreme is a large population which requires the predominance of the food for maintenance of its large numbers and hence synthesizes only enough organisms to balance those lost by normal decay rates. The young population may be visualized as just entering the logarithmic phase and may produce a non-flocculent sludge difficult to settle. The large population is in the resting stage and produces a lower quality effluent through loss of dead organisms which represent a B.O.D. in themselves. Practicable operation requires a population between the two extremes described. The organisms must be young, actively growing cells of a flocculent nature.

To summarize briefly at this point, the kinetics of activated sludge calls for provision of the following for optimum activity:

1. A young, flocculent sludge in the logarithmic stage of growth,
2. Maintenance of the log-growth state by controlled sludge wastage,
3. Continuous loading of the organisms,
4. Elimination of anaerobic conditions at any point in the oxidative treatment,
5. High rate of oxygen transfer into liquid and
6. Vigorous mixing of the biological organisms throughout the oxygen containing liquid.

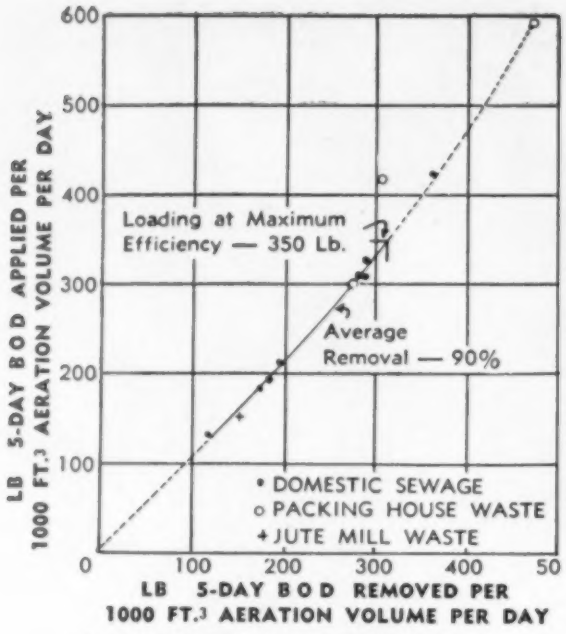


Fig. 2—SUMMARY of B.O.D. loading data.

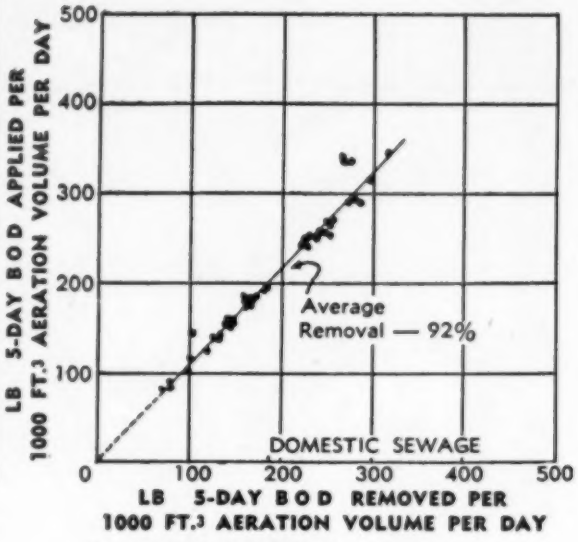


Fig. 3—B.O.D. LOADING for domestic sewage

Design of a New System

With the establishment of the kinetic requirements of activated sludge, the problem of providing an environment meeting these criteria arose. Such a system must be operable under a variety of hydraulic and/or organic loadings.

In attempts to approach the ideal, engineers suggested various modifications of the conventional activated sludge flowsheet. Edwards[6] has published an excellent summary of these proposed and practiced modifications. Included are tapered aeration, step aeration, sludge reaeration, modified aeration, bioprecipitation, the Logan Process and a number of others. Of the above listed modifications, perhaps the Logan Process approaches most closely the theoretical ideal. Logan proposes direct recycling of aeration-tank effluent to the aeration-tank inlet plus return of sludge from the final clarifier. The returned aeration-tank effluent volume is on the order of three to four times that of the sewage flow, with an aeration detention time of one hour for each pass-through.

The common drawback to the above schemes is the anaerobic settling period necessary for clarification of the final effluent and return of sludge to the aeration basin.

Figure 1 shows a new type of a practicable apparatus for meeting the kinetic requirements of activated sludge for maximum treatment efficiency. The pictured item of equipment, known as the "Aero-Accelator" treatment unit, is used in conjunction with a short-term primary tank of about one hour detention if required by the waste characteristics. The initial short period of settling in the primary clarifier, provided in sewage treatment, serves to remove grease and the largest suspended particles. The "Aero-Accelator" unit serves as aeration basin and final clarifier.

The settled waste enters the unit at the bottom center. At this point air is also introduced, through a sparger ring, and is dispersed by a rotor, which is a radial flow type of pumping machine. The intense agitation produced by the rotor insures a condition of complete mixing of untreated waste, air and activated sludge. The lifting action of the air bubbles conveys the sludge mixture up the inner draft tube where the flow discharges through variable opening gates. The mixed liquor then moves down the annular space between the draft tubes to the clarification zone. The activated solids are carried back beneath the hood by the recirculating volume of mixed liquor while clarified effluent flows over the discharge weir at the surface. Under normal conditions of operation the recirculated flow is four to five times that of the throughput. The recirculation rate is controlled by varying the area of the gate-type openings at the top of the inner draft tube.

Solids concentration is controlled by timer-actuated cyclic blowdown of mixed liquor to the primary clarifier, or to a thickener if no primary is required.

Operational Data

Pilot plants of the "Aero-Accelator" have been operated on domestic sewage and various organic industrial wastes. During the summer of 1955 a pilot plant was operated at the Tucson Sewage Treatment Plant for an extended period, and the data obtained are shown in Table I.

The pilot plant consisted of a tank 6 ft.-6 in. in diameter and about 9 ft. high, having a total volumetric capacity of about 285 cu. ft. of which about 100 cu. ft. could be considered as aeration volume. Since aeration volume is one of the basic design factors in connection with the sizing of an "Aero-Accelator" unit, the data are presented so that the amount of B.O.D. removed per unit of aeration volume is shown. The ratio of aeration volume to total volume will vary with size of plant, and the ratio indicated in this pilot plant is not necessarily that required in larger size units. This aeration volume can also be varied for any given size of basin by using different sizes of mechanisms.

The pilot plant was operated at flow rates up to 15 gpm, which gives a total retention time of 2.5 hr and a retention time in the aeration volume of approximately 0.85 hr. The sewage

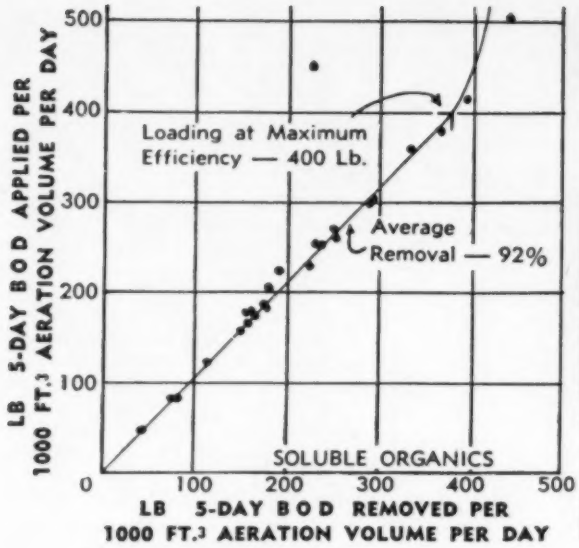


Fig. 4.—B.O.D. LOADING for pilot plant

Fig. 5—THIRTY FOOT "Aero-Accelator" for municipal plant.

entering the pilot plant was given a coarse screening, but there was no primary sedimentation. It is not recommended that an "Aero-Accelator" unit, when handling domestic sewage, be used without primary sedimentation; however, in this case because of the way the Tucson city treatment plant was operated, it was not possible to get proper primary effluent to our pilot plant. Because of this, at times there were excessive amounts of grease and oil which tended to increase the carryover of floc. This is evidenced in the data when the suspended solids in the pilot plant effluent went up to the order of 25 to 35 ppm.

It will be noted that even for a B.O.D. removal of 400 lb per day per 1000 cu ft of aeration volume, an excellent quality of effluent was obtained. It was possible to keep the suspended solids in the circulating slurry or the mixed liquor quite high, with the values many times being of the order of 4,000 ppm. The settling quality of the slurry was usually quite good, except when the floc became loaded with grease and oil. In general, the sludge volume index remained below 200, and never exceeded 300. The air consumption was on an average about 500 cu ft per lb of B.O.D. removed. In many conventional activated sludge plants, this figure is about 1000 cu ft per lb of B.O.D. removed. The relatively shallow pilot plant does not provide the most excellent conditions for high oxygen transfer efficiency. Full size "Aero-Accelator" units many times have used only 300 cu ft of air per pound of B.O.D. removed.

It will be noted that on Sept. 10th and 11th the data shows there was no flow through the pilot plant. This was done deliberately to see whether starvation of the sludge over a weekend, such as would occur in an industrial plant, would seriously affect the treatment when the flow was again started through the plant on Monday morning. Therefore, the flow was shut off Friday evening and there was no flow through the unit until Monday morning; however the air was kept on at 10 cfm. This starvation apparently did not cause any deterioration in the quality of the sludge, nor even in its treating ability, for the data on Monday, Sept. 12th showed good removal of B.O.D. and suspended solids. In other words, with no food supply and with air being supplied at a fairly high rate for a period of some 60 hours, there was no serious affect on the treatment efficiency. These results confirm data presented by Sawyer[6,7]

Figure 2 shows a summary plot of B.O.D. loading data for "Aero-Accelator" pilot plants. These data show that for B.O.D. loadings ranging from 150 to 350 lb per 1000 cu ft of aeration volume per day, the treatment efficiency averaged 89 per cent. The curve shows the effluent quality is a direct function of loading, as is to be expected in a steady state condition. It is to be emphasized that each plotted point on the curve represents a separate experimental installation or evaluation program. The consistency of data obtained from units operated under distinctly different conditions is especially striking.

The data of Fig. 3, obtained from a prototype unit, demonstrate the same remarkable consistency as those of Fig. 2, yielding in this instance an average efficiency of 92 per cent. The plotted points each represent the result of a 24 hr composite sample. Daily analyses were conducted for a 60 day period.

Figure 4 presents data obtained from a pilot installation treating an industrial waste containing soluble organics of various types. In this particular instance, B.O.D. loadings of 400 lb per 1000 cu ft of aeration volume per day were obtained before treatment efficiency dropped below 92 per cent.

An "Aero-Accelator" unit is presently being used for the oxidation of phenolics in a waste stream of the Imperial Oil Co. at Sarnia, Ontario. Since the refinery personnel have published full operational data on this unit,[8] Table 2 shows only a typical day's treatment results.

Discussion

As the emphasis on stream pollution abatement grows, the burden of development of new processes and equipment, using theoretical principles developed by basic research institutions, falls upon the equipment manufacturer. However, such new treatment procedures should be thoroughly tested and proven before the manufacturer can expect the authorities in the field to accept deviations from long established, workable designs. A single pilot plant or prototype installation does not necessarily prove a new development.

This paper represents the first comprehensive, technical disclosure of the treatment potential inherent in the design of the "Aero-Accelator" unit. Data compiled in extensive pilot

TABLE 1

Pilot Plant Data—Tucson Sewage Treatment Plant
Daily Composite Samples
July-September, 1955

Date	Flow gpm.	Air cfm.	B.O.D., ppm Raw	B.O.D., ppm Effl.	Sus. Sol. ppm Raw	Sus. Sol. ppm Effl.	S.S. in Mixed Liquor ppm	B.O.D. Removal lb/1000 cu ft Aeration Vol. per day: Sludge Index	B.O.D. Removal lb/1000 cu ft Aeration Vol. per day: Aeration Vol. per day
7/22	10	10	161	20	228	24	4035	72	192
7/25	10	10	188	15	204	12	1574	64	226
7/26	10	10	176	12	228	15	2340	56	211
7/28	10	10	181	14	208	19	3619	61	217
7/29	10	10	178	13	202	21	3576	61	214
8/1	10	10	230	26	240	23	1724	46	276
8/2	10	10	201	18	230	9	3825	39	241
8/3	10	10	177	25	214	25	4945	45	212
8/4	10	10	188	18	202	11	3675	44	226
8/5	10	10	145	16	202	8	3259	49	174
8/8	10	10	228	30	236	18	2299	39	342
8/9	12.5	10	220	28	198	7	2655	60	330
8/10	12.5	10	190	27	204	12	3825	63	285
8/11	12.5	10	234	25	212	11	3385	50	360
8/12	12.5	10	169	12	210	8	4389	41	254
8/15	12.5	10	238	23	222	12	3747	77	357
8/16	12.5	10	155	25	166	9	4743	87	250
8/17	12.5	10	211	11	210	12	3043	92	317
8/18	12.5	10	203	12	206	11	3013	100	304
8/19	15	12	171	9	174	5	4288	145	308
8/20	15	12					4270	133	
8/21	15	12					4109	132	
8/22	15	12	224	11	216	6	3017	212	404
8/23	15	12	211	12	250	19	5778	83	380
8/24	15	12	208	12	248	4	3021	85	374
8/25	15	12	194	17	198	5	2845	158	349
8/26	15	12	222	13	218	8	1938	130	400
8/27	15	12	133	5	180	7	2251	233	239
8/28	15	12	249	9	256	3	2458	335	448
8/29	15	12	191	11	214	6	2358	230	344
8/30	15	12	186	10	144	3	2285	210	334
8/31	10	10	168	6	196	7	2768	253	202
9/1	10	10	212	8	236	7	2573	280	254
9/2	7.5	10			202	13	3317	280	
9/3	7.5	10	117	12	126	23	3786	246	105
9/6	7.5	10	255	38	246	34	4150	208	230
9/7	7.5	10	233	32	198	26	3286	198	228
9/8	7.5	10	186	33	250	34	3064	219	167
9/9	7.5	10	216	31	216	35	2862	240	204
9/10	0	10							
9/11	0	10							
9/12	7.5	10	267	27	248	22	2896	170	256
9/13	7.5	10	225	25	202	21	2035	118	203
Avg.			198	18	211	14	3244	132	274

plant operations and from full-scale installations are presented. These data represent several years of development efforts.

The accepted design loading for conventional complete treatment activated sludge plants is 30 to 50 lbs B.O.D. per 1000 cu ft of aeration volume per day. Data presented herein show the "Aero-Accelator" is capable of handling up to 400 lb of B.O.D. per 1000 cu ft of aeration volume per day at complete treatment efficiency. In addition to this ten-fold increase in B.O.D. loading capacity, other benefits accrue through utilization of the optimum environment design.

One achievement of this design is the smaller area required and the elimination of large aeration basin and final clarifier structures. Piping layouts are shortened and simplified; return sludge diversion boxes are eliminated.

From the operating standpoint, control of aeration solids is direct and positive. In conventional plants, the wasting of excess sludge to the primary clarifier often results in operating difficulties. The sludge which has been settled in the final clarifier and is devoid of dissolved oxygen does not tend to settle well in the primary basin. The presence of denitrifying organisms may result in no appreciable settling at all. In the design of the equipment described herein, mixed liquor is wasted directly to the primary clarifier or to a thickener. Thus, the solids may be settled before anaerobiosis sets in. In fact, the addition of fresh, gelatinous solids may be expected to aid primary basin performance in removing fine suspended particles from the raw waste. Since a considerable portion of the air diffused into conventional activated sludge aeration basins is required for adequate agitation, appreciable savings in blower horsepower may be realized in a unit utilizing mechanical mixing. In previous papers [9] [10], the author compared net power requirements for dispersing a given amount of oxygen by a rotor and by porous plates or tubes. In contrast to the 1000 cfm of air applied per pound of B.O.D. removed, generally furnished in conventional plants, an "Aero-Accelator" unit requires only 550 cubic feet of air per pound of B.O.D. removed at a loading of 350 pounds of 5-day B.O.D. per 1000 cubic feet of aeration volume per day. Under this condition mixed liquor dissolved oxygen averaged between 3 and 5 ppm. The effluent showed 1 to 2 ppm dissolved oxygen at the surface of the clarification zone.

The standards which led to the statement that proof of a new development rightfully falls on the manufacturer of the equipment, also imply an obligation on the part of the consultant. The engineer who advises municipalities and industries must fully evaluate all treatment processes applicable to a given problem. The mere fact that a new process deviates from the traditional and is unfamiliar to the engineer by reason of its newness does not justify its elimination from consideration. Technological advances in any field necessarily involve acceptance of new, even seemingly radical procedures, providing effective performance is adequately demonstrated.

TABLE 2

Activated Sludge Treatment of Phenolic Waste Water at Imperial Oil Co., Sarnia, Ont., Jan. 18, 1955:

	Raw Waste	Plant Effluent
Temperature °F.	122	99
pH	8.8	8.2
Sulfides, ppm.	20	-
C.O.D.	1815	110
Phenol, ppm.	560	0.22
lb/day	590	0.2

Flow: 120 bbl/hr = 88 g.p.m., M.L.S.S. = 3100 p.p.m., SVI = 123, D.O. = 3 p.p.m.

Summary

A new equipment design based upon providing the optimum operating environment indicated by the kinetics of activated sludge treatment of organic wastes has been developed and operating data from pilot plants and prototype installations are presented.

In one of the classic references on sewage treatment, Imhoff and Fair[11] predicted, "The (activated sludge) process is still capable of further development. One such development will undoubtedly result in a better adjustment of sewage load to sludge activity in order that the purifying power of the sludge may be maintained at maximum level throughout the period of aeration."

The authors believe this predicted development has now been achieved.

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New $6,000,000 L. A. Sewer To Have Plastic Lining

Los Angeles has let a contract for the first unit of a new central outfall sewer which comprises one of the major undertakings in a $6,000,000 expansion program. This section of 10 ft. diameter sewer, more than 4 miles in length, is to be built from the Hyperion Treatment Plant toward the city. A second unit extension is expected to cost an additional $6,000,000.

The present contract went to Arundel Corp., L. E. Dixon Co. and Kemper Construction Co., whose joint offer was the low of eight bids received. The contract calls for completion in two years.

A unique feature of this expensive sewer will be the lining for concrete protection against sulphide sewer gas attack. The lining will be of vinyl plastic T-Lock Amer-Plate, earlier used experimentally on another Los Angeles outfall sewer.

AWWA Opposes Federal Grants For Sewerage Construction

The Board of Directors of AWWA during the 75th Convention in St. Louis, Mo., expressed opposition to proposed Federal grants to municipalities for sewer or sewage treatment plant construction, or betterments to existing plants.

The reasoning behind such opposition to grants in aid, if enacted by the Congress, is the belief that delay in construction of sewage facilities would be experienced. Work would be held up in the hopes of obtaining federal money which is in reality not needed by most cities or towns now able to pay for sewerage betterments through bond issues of one or another sort—especially revenue bonds or their counterpart.

The AWWA Board supported other features of the pending bills in Congress that will provide Federal aid for pollution control research the distribution of which would be through the U.S. Public Health Service.

Baldwin Wood Passes

World Renowned Hydraulician and Pump Designer

A. Baldwin Wood, general superintendent of the Sewerage and Water Board of New Orleans, La., died of a heart attack May 10th. He was 77 years old, and at the time was sailing alone in his sloop. Thus, he died enjoying his favorite diversion of weekend solo cruising from his recreational home in Biloxi, Miss.

Baldwin Wood, a renowned mechanical and hydraulic engineer, was perhaps best known the world around for his 1916 invention of the centrifugal wood trash pump, with its open non-clogging impeller for pumping crude sewage, storm waters and other solids laden liquids. It was a year earlier that he designed and placed in operation the novel screw-type 12 ft. diameter drainage pumps for the New Orleans Sewerage and Water Board. These pumps and the design of the entire New Orleans drainage system brought world-wide fame to Mr. Wood. In all, he held 38 patents of which about 8 proved to be very successful.

Baldwin Wood was "born and bred" in New Orleans. He worked his way through Tulane Univ., won the Glendy Burke Award in mathematics and was graduated in 1899. Late that year he went to work for the Drainage Commission of New Orleans as assistant manager. In 1907 he was made chief mechanical engineer of the newly formed Sewerage and Water Board and devoted much of his time to the design and construction of the new water filtration plant and pumping stations. In 1915 he succeeded Mr. Alfred Raymond as general manager of the Drainage Division of the Sewage and Water Board.

Following the success of the large screw-type drainage pumps of his design, Mr. Wood established a consulting practice which took him all over the world. It was in the early stages of this consulting that he perfected the famed Wood Trash Pump. In 1938 he returned to the Sewerage and Water Board on a full time basis as general superintendent, which position he held up to his death.

Mr. Wood was the recipient of many honors in recognition of his engineering contributions. Tulane in 1939 made him a "Doctor of Engineering." In 1940 he received a plaque from the New Orleans Chamber of Commerce for his "outstanding civic work". In 1954 the City of New Orleans presented to him a plaque in recognition of his 55 years of service to the City and its Sewerage and Water Board. In 1955 the Young Men's Business Club made Mr. Wood a silvercard Honorary Member, in recognition of his inventive, acumen and engineering ability which had proved so vital to the drainage of saucer-like New Orleans.

THE EDITOR'S COMMENTS

Symbols of Integrity . . . and Service

Without doubt most of our readers have at one or another time noticed on our masthead page in every issue of *Water & Sewage Works* the symbol "ABC" in the hexagonal medallion; the symbol "ABP" in the circular medallion; the symbol "SBME" in the circle with quill-pen.

Some of our readers know in a general way what these symbols stand for; some know more specifically what these symbols signify. To give our readers the true meaning of these symbols, in which we take pride, the following is written on the Golden Anniversary of one of these organizations.

First, and foremost, these emblems are all symbols of integrity and service. The "SBME" emblem is that of the relatively recently organized Society of Business Magazine Editors. This is an association of editors which has as its chief qualification for membership the adherence to a Code of Editorial and Publishing Ethics.

The ABC and ABP medallions, which we show as interlocking insignia, are those of a much longer established order. To publish under these symbols signifies that the circulation of the magazine is *paid* circulation which is classified and checked by independent semi-annual audits. So, the ABC insignia, when displayed by a publication, has the connotation of a "stamp of approval" by the Audit Bureau of Circulations. The ABC is supported by publishers for the purpose of having subscriber lists audited and verified by independent and competent auditors. This, in addition to guaranteeing to advertisers a completely honest paid-for circulation, insures to our subscribers that all are treated alike . . . and, treated fairly.

As to the ABP insignia, its display signifies membership of *Water & Sewage Works* in our industry's leading and oldest trade association . . . the Associated Business Publications. ABP membership is open only to those publications which maintain and adhere to circulation methods and publishing ethics evidenced by the prerequisite membership of the publication in the Audit Bureau of Circulations. So, we naturally point with pride to our long-time membership in the ABC and the interlocking ABP.

A word about the Associated Business Publications Inc., which this year is celebrating its Golden Anniversary. This 50 year old trade association has worked consistently through good and bad times to bring about the evolution of one-time designated "trade papers" from their humble, and sometimes helter-skelter, beginnings to the powerful force that the 162 member businesspapers have come to be today.

As a member of ABP we, like all other members, pledge ourselves to adhere to the ABP Code of Ethics and Standards of Practice. This means, among other important things, that we are working always toward the number one ABP objective of constant improvement of service to our readers. It is highly significant that the very first principle set forth in the ABP Code reads "*To consider, first, the interests of the subscriber.*" Although every line in the ABP Code is important to good publishing (therefore, editing and publishing integrity) this initial principle is the one which gives the ABP symbol its real meaning to you, the reader. The full Code reads:

1. To consider, first the interests of the subscriber.
2. To subscribe to and work for truth and honesty in all departments.
3. To endeavor to become a leader of thought in the editorial columns, and to make all criticisms constructive.
4. To encourage all constructive efforts to improve the standards of quality of advertising.
5. To avoid unfair competition.
6. To determine what is the highest and largest function of the field served, and then strive in every legitimate way to promote that function for the benefit of the subscriber and advertiser.

At this time, when the ABP has reached its Golden Anniversary, it seems particularly opportune to use this page to say that we expect to maintain our top-flight status in ABC and to re-pledge our support of the high publishing principles for which ABP stands.

"Caveat Emptor!"

Those who recognize the term "*caveat emptor*" will know that in legal and contractural language this phrase stands for "let the buyer beware", and signifies that the buyer must assume some of the responsibility if he purchases something without "having his eyes open" at the time.

We have been reminded that such a term and condition exists by a recent order, issued by a hearing examiner for the Federal Trade Commission, in the case of charges made before the Commission that a "water conditioning" device marketed through the plumbing, heating and air-conditioning trade is being sold through misrepresentation and spurious claims.

It is claimed that the processed metal element in the conditioner will, through catalytic effects on water passing through it, alter the characteristics of hard waters and render them non-scale forming, less soap consuming, and in general the equivalent of chemically softened water.

The recommendation of the Federal Trade Commissioner's examiner, after extensive hearing on the complaint, is to dismiss the charges that the claims of the manufacturer of the water conditioner are fraudulent. The basis for this is lack of sufficient proof submitted by the complainants.

Here is the phenomenal part of this case. In all there were 122 witnesses, 92 of which were "satisfied customers". On the opposing side, about 20 scientists and experts gave testimony, based in part on tests performed with the conditioner. After weighing all evidence, the hearing examiner feels that sufficient proof that the conditioner will not perform as represented has not been produced—a sufficient case has not been made by the experts. Said the examiner—"We must not risk interfering with the development of a device which may prove to be the first practical application of a scientific principle heretofore undiscovered".

What we would like to know is what kind of experts appeared in the hearings? And, what is the truth about these claims of a catalytic effect and "scientific principle heretofore undiscovered"? In the meantime.—"*caveat emptor.*"

L. H. Enslow

Aer-Degritter and Comminutor installation, Mayfield, Kentucky. Design flow 1.5 M.G.D. Russell, Axon & Associates, Engineers.

AER-DEGRITTER*

Air Controlled Settling Velocities Independent of Flow

The Aer-Degritter* removes grit and sand from sewage through the use of air to effect a controlled velocity of the sewage in the grit tank. The method provides a quiescent zone beneath the air diffusion media to effect a selective deposition of clean grit without organics. There is no need for separate grit washing tanks. Washing and deposition are effected in a single tank.

The principle of air controlled velocities was first demonstrated in sewage treatment plants designed by the office of Charles H. Hurd, Consulting Engineer. The Hurd method, using diffuser plates located behind the hopper, was an improvement over the then practiced means of controlling grit tank velocities. The Aer-Degritter* using diffuser tubes located directly above the hopper is, in turn, an improvement on the Hurd method.

POINTS OF SUPERIORITY OF THE AER-DEGRITTER*

1. Relative location of grit hopper and air diffusers. In the Aer-Degritter* the diffusers are elevated above the tank floor and the grit hopper is directly beneath the air diffusers. This permits greater flexibility of control of tank bottom velocities regardless of volume of sewage flow. It is these bottom velocities that control the deposition of clean grit and fine sand without also depositing organic material. Tests made on grit removed by Aer-Degritters* have consistently shown less than 0.05% putrescibles.

2. The equipment used to introduce air to the sewage. The use of Swing Diffusers and Precision Diffuser Tubes permits easy access to the grit hopper and cleaning of the diffuser media without taking the tank out of service.

**The application of the equipment, as well as the equipment itself is covered by U.S. Patents No. 2,532,457, No. 2,144,385, No. 2,328,655 and No. 2,555,201.*

OVER 140 AER-DEGRITTERS IN* OPERATION IN LARGE AND SMALL PLANTS

CHICAGO PUMP COMPANY
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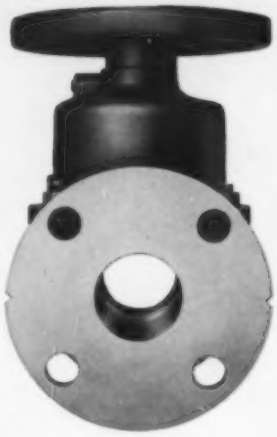

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Grinnell-Saunders STRAIGHTWAY Diaphragm Valves come in a range of body, lining and diaphragm materials. Inquiries invited. Bulletin on request.

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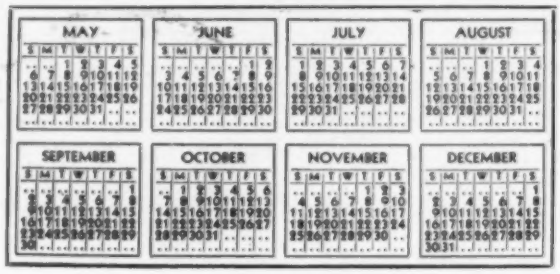

July 9-13—University Park, Pa. (*Pennsylvania State Univ.*)
WATER WORKS SCHOOL, R. Rupert Kountz, Prof. San. Engr. Pennsylvania State University, University Park, Pa.

July 23-27—University Park, Pa. (*Pennsylvania State Univ.*)
SEWAGE WORKS SCHOOL, R. Rupert Kountz, Prof. San. Engr. Pennsylvania State University, University Park, Pa.

July 25—Freeport, Ill.
ILLINOIS WATER PLANT OPERATORS' CONFERENCE, Clarence W. Klassen, Chief San. Engr., State Dept. Public Health, Springfield, Ill.

July 29-Aug. 4—Blacksburg, Va. (*Va. Polytechnic Institute*)
VIRGINIA SHORT SCHOOL FOR OPERATORS WATER & SEW. TREATMENT PLANTS, J. D. Eye, Assoc. Prof. San. Engr., Va. Polytechnic Institute, Blacksburg, Va.

Aug. 8—Kennebunk, Maine
MAINE WATER UTILITIES ASSOCIATION, Gerard F. Laurin, Secy.-Treas., 89 Western Avenue, Augusta, Maine.

Aug. 27-29—University Park, Pa. (*Pennsylvania State Univ.*)
PENNA. WATER WORKS OPERATOR'S ASSN., Secy., R. Rupert Kountz, Prof. San. Eng., Penna. State Univ., University Park, Pa.

August 29-31—University Park, Pa. (*Pennsylvania State Univ.*)
PENNSYLVANIA SEWAGE & INDUSTRIAL WASTES ASSN., Secy., J. R. Harvey, 916 Diamond, Meadville, Pa.

Sept. 5-7—Clear Lake, Iowa (*P. M. Park*)
IOWA SEWAGE & INDUSTRIAL WASTES ASSN., L. F. Skorczeski, Secy.-Treas. 207 South 15th Avenue, Marshalltown, Iowa.

Sept. 9-12—Pittsburgh, Pa. (*Wm. Penn Hotel*)
AMERICAN INSTITUTE OF CHEMICAL ENGINEERS, F. J. Van Antwerpen, 25 West 45th St., New York 36, N. Y.

Sept. 12-14—Bolton Landing, Lake George, N. Y. (*Sagamore Inn*)
NEW YORK SECTION, A.W.W.A., Secy., Kimball Blanchard, 56 Grand St., White Plains, N. Y.

Sept. 12-14—Flint, Michigan (*Durant Hotel*)
MICHIGAN SECTION, A.W.W.A., Secy., T. L. Vander Velde, Mich. Dept. of Health, Lansing 4, Mich.

Sept. 12-14—St. Paul, Minn. (*Lowry Hotel*)
NORTH CENTRAL SECTION A.W.W.A., Secy., Leonard N. Thompson, Gen. Manager, Water Dept., St. Paul 2, Minn.

Sept. 16-19—Bretton Woods, N. H. (*Mt. Washington Hotel*)
NEW ENGLAND WATER WORKS ASSN., Secy., Joseph C. Knox, N.E.W.W.A., 73 Tremont St., Boston 8, Mass.

(*Continued on page 102A*)

Increase vacuum-filter efficiency with PENNSALT FERRIC CHLORIDE

Whether your plant is of large or small capacity, Pennsalt Ferric Chloride can increase vacuum-filter efficiency, speed up sedimentation, meet any change in waste composition. Dosing fresh or digested sludge with $FeCl_3$ permits immediate vacuum filtration, saving months of time.

Pennsalt Ferric Chloride, through superior coagulation, steps up your vacuum-filter capacities. Sludge conditioning with Ferric Chloride results in a drier, denser cake—giving you higher capacity per square foot of filter area. Anhydrous $FeCl_3$ is available in non-returnable steel drums of 135 and 350 lbs.; liquid $FeCl_3$ is shipped by tank car.

Write for free technical information on Ferric Chloride and other Pennsalt Chemicals for water purification and sewerage. Industrial Chemicals Division, Pennsylvania Salt Manufacturing Company, Three Penn Center Plaza, Phila. 2, Pa.

Other Pennsalt Chemicals for water and sewage treatment: Chlorine and Alum.

Pennsalt Chemicals

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Cleveland 2, Ohio—Main 1-6205
Decatur, Ga.—Evergreen 9690
Detroit 26, Mich.—Woodward 1-8051
Paterson 1, N.J.—Lambert 5-3500
Philadelphia 2, Pa.—Locust 4-3852
Pittsburgh 19, Pa.—Atlantic 1-5233
St. Louis 1, Mo.—Parkview 5-8394
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Ideally located in St. Louis, two short blocks from the Union Station and in the center of the Wholesale District . . . Preferred, always by experienced travelers because of its outstanding advantages— Every room with combination tub and shower . . . and circulating ice water. Delicious food . . . cheerful service.

AIR-CONDITIONED ROOMS

350 rooms from $3.50

HOTEL LARIDGE

ERNIE SIMONS General Manager

LOCUST ST. AT EIGHTEENTH

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The Crest of MH Good Living

MASSAGLIA HOTELS

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World-Famed Hotels — Television — Teletype Service

Sept. 17-19—Chattanooga, Tenn. (*Hotel Patten*)
KENTUCKY-TENN. SECTION, A.W.W.A., Secy., J. Wiley Finney, Jr., Howard K. Bell Engrs., 533 S. Limestone St., Lexington, Ky. and KENTUCKY-TENN. INDUSTRIAL WASTES & SEWAGE WORKS ASSN., S. Leary Jones, Secy.-Treas., Cordell Hull Building, Nashville, Tenn.

Sept. 19-21—Atlanta, Georgia (*Georgia Tech.*)
GEORGIA WATER & SEWAGE ASSN., 25th Annual Georgia Water & Sewage School, Georgia Institute of Technology, A. T. Storey, Secy.-Treas., 1210 Hemphill Ave., N. W., Atlanta, Ga.

Sept. 19-21—Toledo, Ohio (*Commodore Perry Hotel*)
OHIO SECTION, A.W.W.A., Secy., M. E. Druly, Dist. Mgr., Dayton Power & Light Co., Wilmington, Ohio.

Sept. 19-21—Aberdeen, So. Dakota (*Hotel to be Announced*)
SOUTH DAKOTA WATER & SEWAGE WORKS CONFERENCE, Charles E. Carl, Secy.-Treas., Div. of San. Eng., State Board of Health, Pierre, So. Dak.

Sept. 23-26—Fort Worth, Texas (*Texas Hotel*)
AMERICAN PUBLIC WORKS ASSN., (Public Works Congress), Robert D. Bugher, Asst. Director, 1313 E. 60th St., Chicago 37, Ill.

Sept. 26-28—LaCrosse, Wisconsin (*Stoddard Hotel*)
WISCONSIN SECTION, A.W.W.A. Harry Breimeister, Secy., Chief Utility Engr., City Engineers Office, City Hall, Milwaukee 2, Wis.

Sept. 30-Oct. 1, 2—Jefferson City, Missouri (*Hotel Governor*)
MISSOURI SECTION, A.W.W.A., and
MISSOURI WATER & SEWAGE CONFERENCE, Warren A. Kramer, Secy.-Treas., Division of Health, Jefferson City, Missouri.

Oct. 2-3—Springfield, Illinois (*Leland Hotel*)
ILLINOIS WATER PLANT OPERATORS' CONFERENCE Clarence W. Klassen, Chief San. Engr., State Dept. Public Health, Springfield, Ill.

Oct. 3-5—Mandan, No. Dakota (*Lewis & Clark Hotel*)
NORTH DAKOTA WATER & SEWAGE WORKS CONFERENCE, Jerome H. Svore, Secy.-Treas., % State Dept. of Health, Bismarck, N. Dakota.

Oct. 4-6—Boise, Idaho (*Hotel Boise*)
PACIFIC NORTHWEST SEWAGE & INDUSTRIAL WASTES ASSN., W. W. Saxton, Secy.-Treas., 408 Old Capitol Bldg., Olympia.

Oct. 8-11—Los Angeles, Calif. (*Hotel Statler*)
FEDERATION OF SEWAGE AND INDUSTRIAL WASTES ASSNS., Ralph E. Fuhrman, Exec. Secy., 4435 Wisconsin Ave., N.W., Washington 16, D. C.

Oct. 10—Caribou, Maine
MAINE WATER UTILITIES ASSOCIATION, Gerard F. Laurin, Secy.-Treas., 89 Western Avenue, Augusta, Maine.

Oct. 14-17—Little Rock, Arkansas (*Marion Hotel*)
SOUTHWEST SECTION, A.W.W.A., Secy., Leslie A. Jackson, Robinson Memorial Auditorium, Little Rock, Ark.

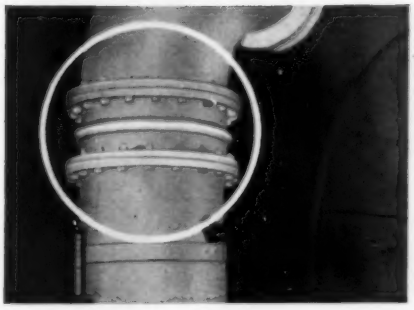
Oct. 15-16—St. John, New Brunswick (*Admiral Beatty Hotel*)
MARITIME BRANCH, CANADIAN SECTION, A.W.W.A., J. D. Kline, Secy.-Treas., Public Service Comm., P.O. Box 608, Halifax, N. S.

Oct. 15-17—Philadelphia, Pa. (*Drake Hotel*)
NATIONAL ASSOCIATION OF CORROSION ENGINEERS, NORTHEAST REGION, A. B. Campbell, Exec. Secy., 1061 M & M Bldg., Houston 2, Texas

Oct. 15-19—Pittsburgh, Pa. (*Wm. Penn Hotel*)
AMERICAN SOCIETY OF CIVIL ENGINEERS, Exec. Secy., W. H. Wisely, 33 W. 39th St., New York 18, N. Y.

(*Continued on page* 104*A*)

How long can a U. S. Rubber Expansion Joint last



...some have been on the job since 1926, the year they were invented!

Here are just a few reasons why *these flexible connections are used in pressure or vacuum pipe lines...*

- U. S. Rubber Expansion Joints are resilient and, therefore, do not, like metal, set permanently when compressed.
- Constant flexing merely keeps "U. S." joints "alive"... prevents them from becoming brittle.
- They absorb both axial *and* lateral deflection far more than metal joints. Greater insulation against vibration and pump noises is provided.
- There is never any electrolysis, corrosion or erosion.
- U. S. Rubber joints handle pressures from 40 lbs. to 125 lbs. Compare!
- The outside diameter of the arch is smaller than that on metal joints. Face-to-face dimensions (even with multiple arches) are smaller.
- Weight is much less. This, plus the fact that no gasket is needed between flanges (unlike metal joints) results in an easier installation, lowering the cost.

"U. S." was the first to develop rubber expansion joints. They are at work in every kind of industry, prolonging the life of equipment in pressure or vacuum pipe systems. Obtainable at any of the 28 "U. S." District Sales Offices, or write us at Rockefeller Center, New York 20, N. Y.

US RUBBER

Mechanical Goods Division

United States Rubber

Oct. 18-20—Atlantic City, N. J. (*Hotel Madison*)
NEW JERSEY SECTION, A.W.W.A., Secy., C. B. Tygert, Box 178, Newark 1, N. J.

Oct. 21-24—Mobile, Alabama (*BattleHouse*)
ALABAMA-MISSISSIPPI SECTION, A.W.W.A., Secy., Irving E. Anderson, U.S.G.S. Box 2052 Jackson, Miss.

Oct. 22-24—Pittsburgh, Pa. (*Hotel William Penn*)
ENGINEERS' SOCIETY OF WESTERN PENNSYLVANIA (17th Annual Water Conference) W. M. Porter, Secy., Hotel William Penn, Pittsburgh 30, Pa.

Oct. 22-26—San Diego, Calif. (*U.S. Grant Hotel*)
CALIFORNIA SECTION, A.W.W.A., H. J. Ongerth, Secy.-Treas., 905 Coutra Costa Av. Berkeley, Calif.

Oct. 23-26—San Antonio, Texas (*Gunter Hotel*)
NATIONAL ASSOCIATION OF CORROSION ENGINEERS, SOUTH CENTRAL REGION, A. B. Campbell, Exec. Secy., 1061 M & M Bldg., Houston 2, Texas.

Oct. 24-26—Des Moines, Iowa (*Hotel Fort Des Moines*)
IOWA SECTION, A.W.W.A., Secy., J. J. Hail, Sup. of Water, City Hall, Dubuque, Iowa.

Oct. 24-26—Baltimore, Maryland (*Sheraton Belvedere*)
CHESAPEAKE SECTION, A.W.W.A., Secy., Carl J. Lauter, 6955 33rd Street, Washington 15, D. C.

Oct. 29-31—Windsor, Ontario (*Prince Edward Hotel*)
THE CANADIAN INSTITUTE ON SEWAGE & SANITATION, A. E. Berry, Secy.-Treas., Ontario Dept. of Health, Parliament Bldg., Toronto, Canada.

Oct. 31-Nov. 1-2—Bluefield, W. V. (*West Virginia Hotel*)
WEST VIRGINIA SECTION, A.W.W.A., Secy., Hugh W. Hetzer, Engr., W. Va., Water Service Co., Charleston, W. Va.
(*Jointly With*)
WEST VA. SEWAGE & IND. WASTES ASSN., G. O. Fortney, Secy.-Treas., State Health Dept., Charleston 5, W. Va.

Nov. 1-2—Omaha, Nebraska (*Castle Hotel*)
NEBRASKA SEWAGE & INDUSTRIAL WASTES ASSN., V. J. Lechtenberg, Secy.-Treas., 614 Standard Oil Bldg., Omaha, Neb.

Nov. 7-9—Old Point Comfort, Virginia (*Chamberlin Hotel*)
VIRGINIA SECTION, A.W.W.A., Secy., J. P. Kavanagh, 213 Carlton Terrace Bldg., Roanoke, Va.

Nov. 11-14—Daytona Beach, Fla. (*Daytona Plaza Hotel*)
FLORIDA SEWAGE & INDUSTRIAL WASTES ASSN., M. E. Dawkins, Secy.-Treas., % Reynolds, Smith & Hills, P.O. Box 4817, Jacksonville 1, Fla.

Nov. 12-14—Charlotte, N. C. (*Hotel Charlotte*)
NORTH CAROLINA SECTION, A.W.W.A.,
(*Jointly With*)
NORTH CAROLINA SEWAGE & INDUSTRIAL WASTES ASSN., W. E. Long, Jr., Secy.-Treas., Box 2091, Raleigh, N. C.

Nov. 12-16—Atlantic City, N. J. (*Convention Hall*)
AMERICAN PUBLIC HEALTH ASSN., Secy., Dr. Reginald M. Atwater, 1790 Broadway, New York, N. Y.

Nov. 15-16—Detroit, Michigan (*Hotel Statler*)
NATIONAL ASSOCIATION OF CORROSION ENGINEERS, NORTH CENTRAL REGION, A. B. Campbell, Exec. Secy., 1061 M & M Bldg., Houston 2, Texas.

Nov. 26-28—Colorado Springs, Colo. (*Broadmoor Hotel*)
ROCKY MOUNTAIN SECTION, A.W.W.A., Jack W. Davis, Secy., Johns-Manville Sales Inc., Denver, Colorado.

Dec. 12—Pittsfield, Maine
MAINE WATER UTILITIES ASSOCIATION, Gerard F. Laurin, Secy.-Treas., 89 Western Avenue, Augusta, Maine.

BORDEAUX, FRANCE, OPENS ABANDONED SEWER in 30 minutes!

Bordeaux would have been satisfied if the SeweRodeR had opened this line in any reasonable time; they never dreamed it would be flowing within 30 minutes after starting the job. Before the SeweRodeR arrived, a French crew, using their regular cleaning methods, had given up after a week of futile effort.

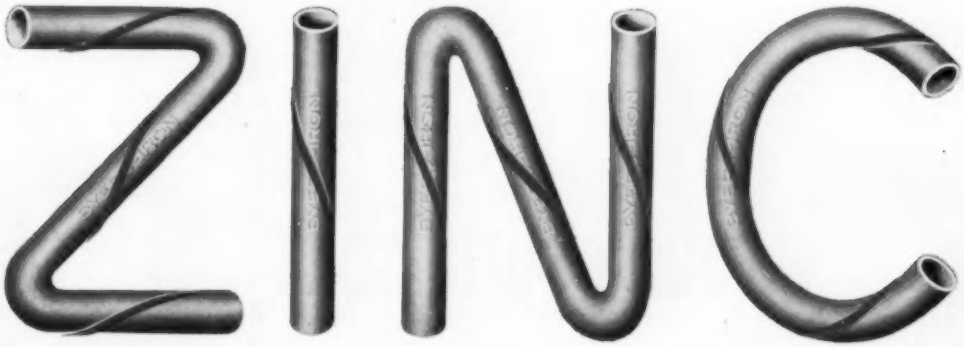
According to a recent survey in the U.S., average sewer replacement costs are about $11.50 per foot. Under conditions similar to those in Bordeaux, the SeweRodeR could easily pay for itself on the first job by saving pipe marked for replacement.

The ***SeweRodeR*** *not only does "impossible" jobs, but it does them faster, with lower costs per foot of pipe cleaned, and with greater safety and improved working conditions. Contact your nearest "Flexible" distributor for full details.*

FLEXIBLE INC.
3786 Durango Ave., Los Angeles 34, Calif.
(Distributors in Principal Cities)

An engineering fact...

WROUGHT IRON PIPE takes up to a 50% heavier coating of ZINC



Tests prove the iron silicate fibers which give wrought iron its unusually high resistance to corrosion are also responsible for the material's ability to accept a considerably thicker hot-dip zinc protective coating than steel.

Our bulletin, *Piping for Permanence*, discusses galvanic protection, and reviews a variety of wrought iron pipe services. Write for your copy.

A. M. Byers Company, Pittsburgh, Pa. Established 1864. Division Offices in Boston, New York, Philadelphia, Washington, Atlanta, Chicago, St. Louis, Houston, San Francisco. International Division: New York, N. Y.

Available in Canada and throughout the world

These photomicrographs illustrate the ability of wrought iron to receive a tighter, heavier zinc coating. Because the life of the coating is directly influenced by its adherence and weight or thickness, zinc coating on wrought iron lasts longer.

BYERS *Wrought Iron Tubular and Hot Rolled Products*

ALSO ELECTRIC FURNACE QUALITY STEEL PRODUCTS

W&SW

Spillway

OVERFLOW FROM THE MAIN SECTION

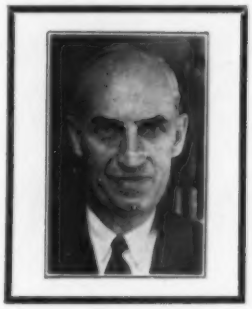
Leon A. Smith is Dead

Succumbs to attack at A.W.W.A. Convention

Leon A. Smith, for the past 40 years superintendent of water at Madison, Wisconsin, died in St. Louis, Mo., May 10th, while attending the 75th annual convention of the American Water Works Association. He was 66 years old. With him at the time of his passing was his wife, who accompanied him to the convention.

Leon Smith, born Aug. 3, 1890 in Elgin, Ill., attended the University of Wisconsin in Madison. Upon graduation in 1912 he became assistant city engineer of Madison. In 1916 he was appointed water works superintendent, thereby having served the City of Madison for 44 years, during 40 of which he was superintendent of water.

In 1953 Leon Smith was publicly commended by the Madison Board of Water and Sewerage Commissioners for his "highly efficient and economic handling of the position of water superintendent," and for his "ability to foresee and correct deficiencies before they occurred." The local press referred to Smith as a "civic leader" who had on several occasions declined offers of nomination for the mayorship of Madison.



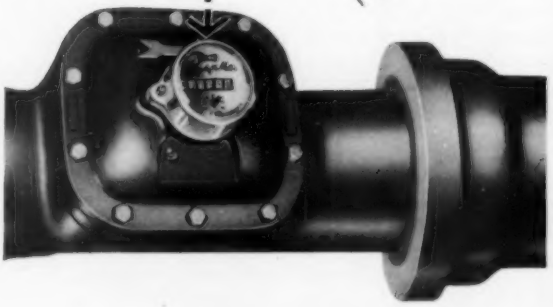
Leon Smith had for 30 years served as Secretary of the Wisconsin Section of A.W.W.A. in a highly praiseworthy manner. In 1938 he received the first Fuller Award voted by the Section for "distinguished service in the water supply field." In recognition of 25 years of service as Secretary-Treasurer of the Section, he was presented with a television set and honored by a large out-of-state attendance on the occasion. His 30 year service as Section secretary constitutes a record for such service in the A.W.W.A., of which he was a former Director. He was also past-chairman of the Section.

Leon Smith, in 1949, received a citation from the Regents of the Univ. of Wisconsin for "outstanding accomplishments in the field of water supply engineering." He was active in community affairs, having served as president of the Rotary Club of Madison; the Blackhawk Country Club; the Madison Technical Club; the First Congregational Church Board of Trusteees; and the Engineering Society of Wisconsin. He was the author of a booklet entitled, *"Madison—a Fine City in Which to Live"*, which developed from talks made by him before civic groups. Mr. Smith was an active Mason and a director of

don't surmise...

totalize!

Builders-Providence PROPELOFLO® is a direct-reading, propeller-type meter designed for main line totalizing of water consumption . . . available in 2 to 20 inch sizes . . . with flanged, bell and spigot, and threaded ends. Rated capacities range from 15 to 5800 gpm . . . accurate to within plus or minus 2% of actual flow. For complete information, write to Builders-Providence, Inc., 350 Harris Ave., Providence 1, Rhode Island.



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BIF METERS FEEDERS CONTROLS

the Madison and Wisconsin Foundation, and the Madison YMCA. For a time he served as chairman of the Madison Housing Authority in addition to his duties as water superintendent. He helped Madison grow from a town of 25,000 to a city of 100,000.

Leon Smith was an unassuming man who accomplished much. That Madison realizes its loss, is clearly evident from the expressions given on the front pages of Madison's newspapers on the occasion of his passing.

Interest in Re-Use of Sewage Plant Effluents Growing

In these times when adequate water supply for industry is becoming more of a problem, interest in the possible use of sewage treatment plant effluents by industry is on the increase.

At a recent meeting of the Am. Institute of Mining and Metallurgical Engineers the following opinion was voiced by several speakers. In procuring an adequate water supply for many industrial uses the most dependable, cheapest and best source of such water is often the effluent of sewage treatment plants.

The speakers noted that water which has already been used as a domestic water supply is frequently softer and chemically more desirable for industrial uses than water from other sources, even the "clean" water supply of the city. This, they say, is due to the housewives having contributed softening and conditioning agents in the use of the water. Thereby, the effluent from a sewage plant can be treated by the user of the city's "used water supply" at slight additional cost.

In support of the argument the successful and economical use of sewage plant effluent by the Bethlehem Steel Co. at Baltimore and the Texaco Refinery at Amarillo, Texas, were amongst cases cited.

Pick-ups from Purdue's "San. Eng. News."—Don Bloodgood, Editor

Liquid alum is used at the South District Filtration Plant in Chicago, Ill. The contract price in 1954 was 7.5% less than for dry alum. It is also being used at Gary, Ind., and elsewhere.

* * *

The following gives the approximate pounds of CO_2 to be derived through the combustion of commonly used fuels assuming 100% combustion and no after washing out with scrubbers: 3 lbs. from 1 lb. of coke; 82 lbs. from 1000 cu. ft. of manufactured gas; 115 lbs. from 1000 cu. ft. of natural gas; 20 lbs. from 1 gallon kerosene oil; 23 lbs. from 1 gallon No. 3 fuel oil; 3 lbs. from producer gas from 1 lb. gasified coke.

* * *

It has been demonstrated at Fairbanks, Alaska, that a simple 100-gallon flush tank supplied with ground water at 33° F. not only will prevent the freezing of a sewer, but will also thaw a sewer filled to the longitudal axis with ice.

* * *

A study of high-rate filtration carried on at the Dalecarlia Filter Plant, Washington, D. C., shows that, with proper pre-treatment, filter effluent meeting present standards of chemical quality, turbidity, and bacteriological purity can be produced at high rates of filtration—up to 5 gpm. per square foot.

* * *

Miami, Florida, chooses diesel power for new water treatment plant.

* * *

More than 60 per cent of Denver's total annual water supply is derived from winter snow in the Upper South Platte River Basin in the Colorado Rockies.

FROM THE FILES OF DR. CENTRILINE...

CASE #6042

PATIENT: 36 miles of twin 20" Cast Iron supply lines, Portsmouth, Virginia.

SYMPTOMS: Insufficient water in Portsmouth.

DIAGNOSIS: Low pipeline capacity caused by flow restricting tuberculation.

TREATMENT: The twin 20" mains were cleaned and cement lined in place without interruption of water supply service to Portsmouth. The Centriline Process of centrifugally applying cement mortar was used.

RESULTS: Each pipeline is now capable of permanently carrying twice as much water as prior to cleaning and lining.

Examine your own capacity, corrosion and leakage problems to determine the value of the Centriline treatment to you. Cleaning and cement lining in place has been the successful remedy for almost 1,000 miles of water supply pipelines.

CENTRILINE CORPORATION

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• If interested in equipment or literature mentioned below, mail a Reader Service Card with your name, address, and item key number.

W&SW

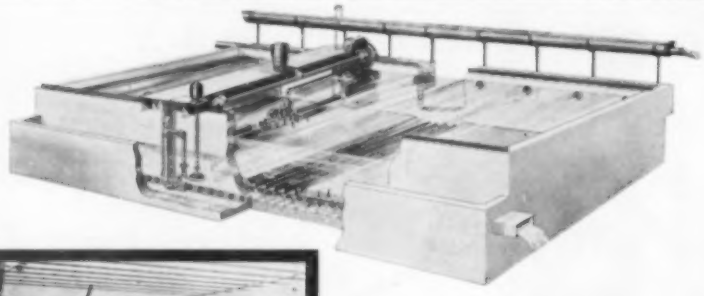
New Equipment

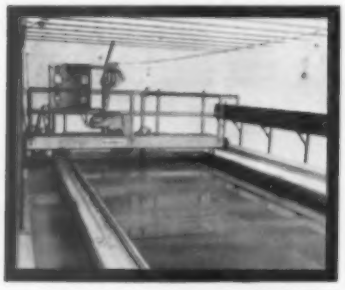
Allis-Chalmers Expands Line of "ACAP" Pumps

701

Allis-Chalmers Manufacturing Company, Milwaukee, Wis., has announced the broadening of its line of "ACAP" pumps for handling solids in suspension under variable capacity and head conditions.

The pumps are now available in a size range of from 425 gpm, 35-ft head, at 965 rpm to 46,000 gpm, 58-ft head at 514 rpm. They can be either manually or automatically controlled.





12½′ x 40′ Hardinge Automatic Backwash Sand Filter in a municipal water plant in Vermont.

12½′ x 86′ Hardinge Filter handling water supply for a Canadian paper plant.

A sand filter which

CLEANS ITSELF

The Hardinge Automatic Backwash Sand Filter is a complete departure from standard filtration equipment, in that it backwashes its filter bed automatically without interrupting normal filtration.

The ABW filter in combination with flocculation and sedimentation equipment provides treated and filtered water for municipal and industrial water supplies.

The filter may be applied also for the treating of plant waste water, for reuse or disposal.

Complete specifications upon request. Bulletin 46-A-15.

HARDINGE
COMPANY, INCORPORATED

YORK, PENNSYLVANIA • 240 Arch St. • Main Office and Works

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Flag Pole Odor Control Vent

702

Stuart Corp., Baltimore, Maryland, has announced a flag pole ventilating unit for odor disposal at sewage plants, sewage lift stations, etc.

The poles are of tapered tubular aluminum and constructed to withstand 125-mile per hour wind loading. The ventilating opening at the

top of the pole has been designed to avoid restrictions and turbulence in the air flow, and a covering shield prevents the entrance of rain. Pulley, cleat and other accessories for the flag support are made of aluminum or stainless steel.

Also contained in the flag pole is a driving motor directly connected to the blower that provides exhaust ventilation.

Pipelaying Attachment For Crawler Tractors

703

Midwestern Manufacturing Co., Inc., Tulsa, Okla., has developed a pipelaying attachment for use with Caterpillar D2 tractors.

Known officially as the No. 2 Side Boom, the new attachment makes the economies possible

with a heavy-duty crawler-type machine available for the first time to builders of small and medium sized gas, water and sewer lines.

The new pipelayer has a lifting capacity of 8400 lbs. at 2 ft. overhang. Easy operation of the heavy-duty boom and load winches is assured by the use of hydraulic controls. Only two levers are used to control the pipelayer's action.

Gravity Grip Pipe Vise

704

Spring Load Manufacturing Corp., Seattle, Washington, has designed a new model Gravity Grip pipe vise to hold asbestos-cement and clay pipe.

The new V-20 model vise holds the pipe at a convenient working height and angle, adjusts to hold from 4 to 20 inch pipe in seconds, gives steady and complete control.

While especially designed for use with Spring Load's pipe cutters, machining and tapering tools, it works equally well with all similar tools.

Foam Control Chemical

705

Fine Organics, Inc., New York, N. Y., has developed Foamwilt, a scientifically compounded material which appears to be superior, after various tests, to presently existing foam control products being used in sewage disposal plants, particularly where the processing involved aeration.

According to the company, Foamwilt has been tested in several large installations and has been in use with satisfactory results.

Multiple Drive System Provides Synchronized Speed Changes

706

U. S. Electrical Motors Inc., Los Angeles, Calif., has developed a new drive system of synchronized variable speed, multiple drives called the U. S. Varidyne.

The heart of the system is a specially designed U. S. Varidyne power unit which interlocks Varidyne motors by means of electrical impulses. Simply turning the con-

(*continued on page* 110*A*)

Model 140 Cleveland Trencher helps get $14,000,000 sanitary sewer construction program underway in St. Petersburg, Fla.

The Cleveland Trencher Model 140 shown above—one of three Clevelands currently being operated by Richards Constructors of Andalusia, Ala.—is completing a 400-foot run of trench on Snell Isle Blvd. in St. Petersburg. 8-inch cast iron pipe is being installed here for lift pump lines. Richards really had "trench on tap" for this job because of the exclusive wide range of digging speeds provided by his 140. This allowed him to open up just the trench footage needed at any time to meet the pipe gang's requirements. When more trench was needed, the speed to produce it "right now" was available in the Cleveland's reservoir of speeds—a reservoir of more than 33 usable combinations of digging wheel and crawler speeds, ranging from 6 inches to over 37 feet per minute.

Richards Constructors know that no matter what the digging conditions may be on their next job—hard or soft, wet or dry, shallow or deep—their Clevelands have what it takes to get the job done with 100% efficiency.

Talk it over with your Cleveland distributor

THE CLEVELAND TRENCHER CO.

20100 ST. CLAIR AVENUE • CLEVELAND 17, OHIO

Good Everywhere

trol dial on the power unit varies the speed of every motor in the Varidyne system equally and simultaneously. Varidyne motors are of the AC, squirrel-cage induction type, connected to the power unit by means of standard 3-phase circuitry.

A very valuable characteristic of the system is that when the motors are operating in tandem, as on a single conveyor, they will equally share the load. This single factor eliminates costly damage from extreme overloads at any one point on the conveyor, which is typical of systems without equal load distribution.

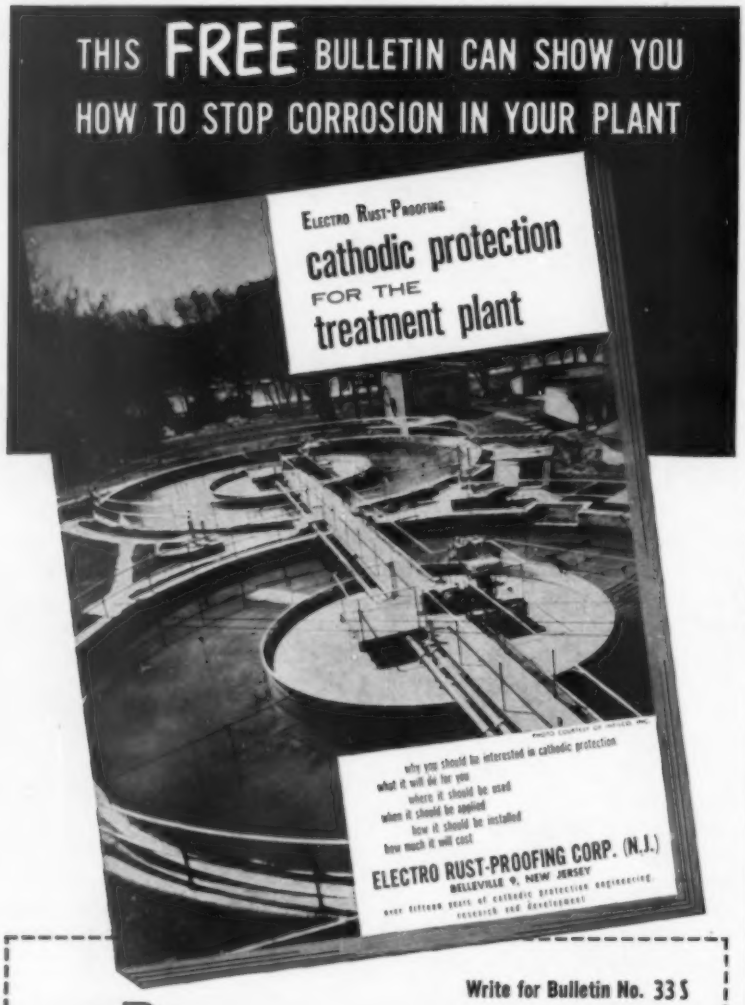
A Field Monitoring Kit Introduced by Millipore Filter Corp.

707

The Millipore Filter Corp. of Watertown, Mass., are now offering a complete monitoring Kit for field use, thus making it possible to sample water etc., draw it through the membrane filter on the spot, add the bacterial growth media, incubate and make bacterial counts, all out in the field. As an alternate the membrane filter-disc to which growth media has been added in the field, to a self contained incubation dish, can be transported to a laboratory for completion of incubation and counting.

In the field the sample of desired volume is drawn upwards through a tube and through the Field Monitor Membrane Filter with a small hand syringe shown at close range in one of the accompanying pictures. The growth media is then added from a sterile ampule (as pictured here) with the aid of the sampling syringe, still attached. The top cap is then placed on the sterile plastic incubation dish, which does double duty as holder of the membrane filter in the filtering step and incubation dish thereafter. The sealed culture unit may now be incubated in the compact portable electric incubator (not pictured) or shipped to a laboratory. During transit bacterial growth is already under way from a "fresh" sample, rather than a stored or shipped sample.

The Field Incubator offered, as a separate unit by Millipore Filter Corp. is not pictured. It is about the size of an automobile battery, well insulated, compact and neat. It operates on either 6 or 12 volt current from an automobile battery. It may also be operated on house current of 110 or 220 volts. It will hold up to 170 F.M. incubation dishes or 94 culture tubes.


THIS FREE BULLETIN CAN SHOW YOU
HOW TO STOP CORROSION IN YOUR PLANT
ELECTRO RUST-PROOFING
cathodic protection
FOR THE
treatment plant
why you should be interested in cathodic protection
what it will do for you
where it should be used
when it should be applied
how it should be installed
how much it will cost
ELECTRO RUST-PROOFING CORP. (N.J.)
BELLEVILLE 9, NEW JERSEY

Write for Bulletin No. 335

CATHODIC PROTECTION ERP

ELECTRO RUST-PROOFING CORPORATION

30 MAIN STREET, BELLEVILLE 9, N. J.

ATLANTA CHICAGO DALLAS MONROVIA SEATTLE

E-33

four different water supplies from one water treatment plant by GENERAL FILTER

The Plains Electric Generation and Transmission Co-operative recently completed at Algodones, New Mexico, provides 30,000 kilowatts per hour to Southwest consumers.

A water treatment plant capable of providing suitable water in sufficient quantities for four different supplies was required by the consulting engineers:

- COOLING WATER for the condensation of turbine steam.
- SANITARY WATER for drinking and sanitation.
- MAKE-UP WATER for the boilers.
- SERVICE WATER for fire protection and general utility.

With the system installed one operator can check, alter and control the treatment process from a master control panel . . . confident of complete dependability . . . minimum maintenance.

Ask for recommendations for a water treatment plant "job-engineered" to your requirements . . . a fast, efficient, economical system by General Filter.

General Filter Company
AMES, IOWA

• **If interested in equipment or literature mentioned below, mail a Reader Service Card with your name, address, and item key number.**

Protective Coating

708

Maintenance, Inc., Wooster, Ohio, has developed a new all-purpose black coating for protecting metal, wood or concrete against practically every exposure condition.

The new paint is reputed to form an attractive, bright ebony black finish that is impervious to moisture and resistant to chemical attack by gas fumes and smoke. Because of its penetrating and spreading qualities, it can be used after a minimum of surface preparation to either preserve or restore the apperance of most materials. It is anti-corrosive above or below grade.

Hydraulically Powered Drilling Unit

709

Mobile Drilling, Inc., Indianapolis, Ind., has developed a new hydraulically powered drill.

Engineered to operate as a core or auger drill, it may be adapted for tractors and vehicles or independently driven by a motor mounted at the rear of any vehicle. For hard formations, either air or water may be used with hollow-stem augers. The drill cores to 200 feet and augers to 75 feet. The 15 H.P. hydraulic motor is geared to high torque low speeds and assures a positive, steady drill action.

Said to be ideal for under-road boring as well as nearly every exploratory job, the unit has also been designed to cut costs on installation of underground water, gas, and power lines. One-man operated, it can be converted easily to drill at any degree in a 360° angle, and is light enough for air transport to remote areas.

FILTER PLANT EQUIPPED WITH MOTOR OPERATED M&H VALVES

There are four principal uses for electric motor operated M & H Gate Valves:

1. **Facilitate opening and closing of large valves.**
2. **Control and expedite frequent operation of valves.**
3. **Simplify operation of valves installed in remote, inaccessible or hazardous locations.**
4. **Reduce operating costs and increase efficiency.**

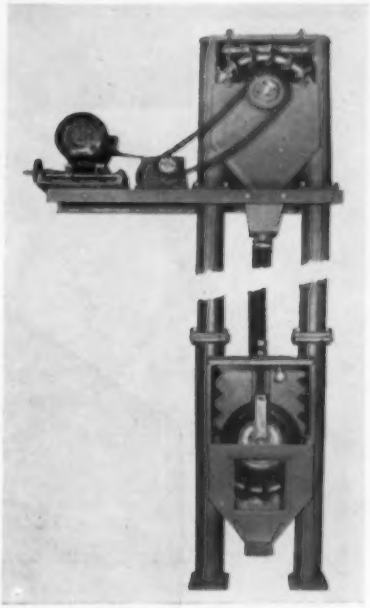
The motor operated valves in the pipe gallery shown below are standard M & H Gate Valve design and construction. They are available in all sizes for 50, 100, 150 or 250 lbs. working pressure, and with standard accessories such as square bottom design, rollers-tracks-and-scrapers, indicators, etc. For complete information, address

M&H VALVE AND FITTINGS COMPANY
Anniston, Alabama

M&H PRODUCTS
FOR WATER WORKS • FILTER PLANTS INDUSTRY • SEWAGE DISPOSAL AND FIRE PROTECTION

Cableveyor-Elevator

710



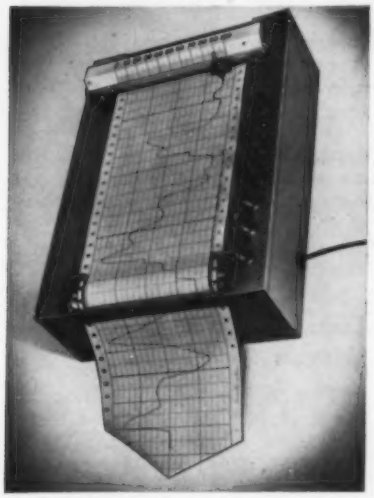
Hapman Conveyors, Inc., Kalamazoo, Mich., has announced the new Hi-Lift Cableveyor-Elevator for elevating free-flowing materials such as dry wastes, gravel, sand, coal, ashes, chemicals and other by-products.

Available with 4, 8, or 12 inch diameter tubes, the elevator has a center discharge chute for low speed of 60 FPM or side discharge for high speed up to 250 FPM.

Said to contain fewer parts than any comparable elevator, the unit consists of standard steel cable carrying concave stamped or cast metal buckets, uniformly spaced by heavy springs under compression. There are no rivets, bolts or other fastenings to wear out, and the design permits cable to flex naturally under low stress. Also unique is the use of

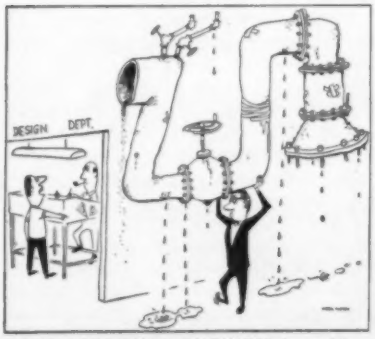
pneumatic rubber-tired drive and take-up wheels which eliminate sprockets. A simple take-up screw provides generous adjustment of cable stretch.

Servo-Graphic Recorder
711



The C. H. Stoelting Co., Chicago, Illinois, has developed a new portable and low cost strip chart recorder that operates on a self-balancing potentiometer principle. With appropriate sensing devices, it will record temperature, speed, light, pressures, resistance, motion or any variable that can be represented by a D. C. millivolt signal within its range.

The design features rectilinear tracings, 100 MV full scale, high input impedance, excellent reproduceability, high stability, 1% accuracy, faultless vertical or horizontal ink writing, high torque, servo motor, 5 inch pen travel, synchronous motor paper feed, sprocket driven chart, table or wall mounting, rugged construction, plus many others.



OUR CORROSION ENGINEER is on his way here to discuss a "little problem", as he calls it!
'Cartoon, courtesy Amercoat Corp. of Calif.'

TC
TENNESSEE CORPORATION

Ferri-Floc
FERRIC SULFATE

The Superior
COAGULANT

Ferri-Floc gives smoother, more efficient and trouble free operation. Whatever your particular water treatment problem may be, you can depend on Ferri-Floc doing a superior job and doing it efficiently and economically—Ferri-Floc is a free flowing granular salt which can be fed with few modifications through any standard dry feed equipment. It is only mildly hygroscopic, thereby permitting easy handling as well as storage in closed hoppers over long periods of time.

With The Plus **FACTORS**

Excellent Taste and Odor Control — Coagulation Over Wide pH Range
Rapid Floc Formation — Color Removal — Bacteria Removal
Turbidity Removal — Manganese and Silical removal
Ease of Operation — Economical — Increased Filter Runs

WATER TREATMENT

Efficient coagulation of surface or well water. Effective in lime soda-ash softening. Adaptable to treatment of all industrial applications.

SEWAGE TREATMENT

Ferri-Floc coagulates wastes over wide pH ranges — It provides efficient operation regardless of rapid variations of raw sewage — Is effective for conditioning sludge prior to vacuum filtration or drying on sand beds.

LIQUID SULFUR DIOXIDE
HIGHEST QUALITY
SO_2
Available in: Cylinders, Ton Drums, Tank Trucks and Tank Cars

TC
LIQUID SULFUR DIOXIDE
SULFUR-DIOXIDE is effectively used for dechlorination in water treatment and to remove objectionable odors remaining after purification.

COPPER TC SULPHATE

COPPER SULFATE
COPPER SULFATE will control about 90% of the microorganisms normally encountered in water treatment plants more economically than any other chemical.

TENNESSEE TC CORPORATION
617-29 Grant Building, Atlanta, Georgia

Let us send you without charge, a 16-page [illegible] on Ferri-Floc and specific data on phases of coagulation—just send us a postal card.

W&SW

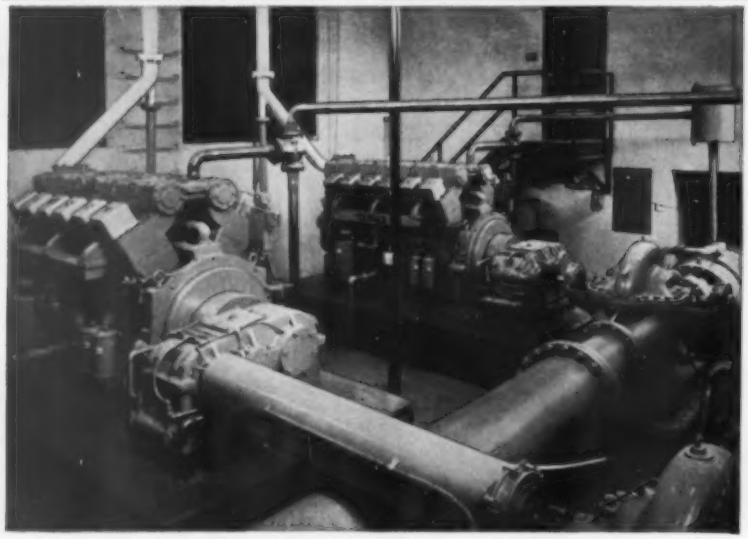
Manufacturers' News

A. L. Morris Heads Company Relations At Dorr-Oliver

Dorr-Oliver Incorporated Stamford, Conn., has announced the promotion of Albert L. Morris to the new post of Director of Company Relations. With the retirement of Wm. Harold Oliver as Vice President for Public Relations and Personnel, after nearly 46 years of service, Mr. Morris has assumed over-all responsibility for all public relations and personnel functions of Dorr-Oliver and its subsidiaries.

Mr. Morris has been the Director of Public Relations for the past year and previously held the posts of Advertising Manager and Assistant Director of Public Relations and Personnel. After leaving Syracuse University in 1937 he joined the D-O Advertising Department and became Assistant Manager and Acting Manager of Advertising prior to World War II.

Upon his return from 2½ years' service with the Marine Corps Personnel Section, Mr. Morris was named Advertising Manager. During the years following he was largely responsible for the reorganization of that department of Dorr-Oliver.



IN SOUTHERN CALIFORNIA

Climax natural gas engines are generally selected for driving pumps for irrigation and in Municipal Water Works due to modern design, dependability and quick starting.

Photograph shows two model V-125, 12 cylinder engines operating at 855 RPM, driving 4500 GPM Peerless centrifugal pumps through speed increasers, in the Moreno Booster Station of the Eastern Municipal Water District, near Hemet, California. Automatic controls start and stop the engines as needed to maintain a constant pressure in the mains under variable flow conditions.

climax

FOR COMPLETE INFORMATION, WRITE TO . . .

ENGINE AND PUMP MFG. CO.

208 So. La Salle St.

CHICAGO 4, ILLINOIS

Factory—Clinton, Ia. *District Office*—Dallas, Tex.

Ludlow Valve Re-Elects Officers

The Ludlow Valve Mfg. Co., Inc., Troy, N. Y., has announced the re-election of all present officers by the company's board of directors.

Livingston W. Houston, president, Rensselaer Polytechnique Institute, continues as chairman of the board; Oliver F. Gang, president; John Ireland, vice president and treasurer; Lindsley McChesney, secretary and Robert A. Ireland, assistant treasurer and assistant secretary.

Clarence H. Daniel, who resigned as a member of the board of directors because of the pressure of other responsibilities was replaced by Earle W. Pughe, a mechanical engineer, who will also serve as chairman of the executive committee.

Directors John O. Amstuz, vice president—research, the Behr-Mann ing Division of Norton Co. and Mr. McChesney were elected as members of the executive committee.

Penn Instruments Names Two Municipal Representatives

Penn Instruments Division, Burgess-Manning Company, Philadelphia, Pa., has announced the appointment of two firms to represent the company in the municipal field, handling metering and control instruments for water, sewage and industrial waste.

The appointees are: E. R. Parkhurst Company, 1511 Fishburn Street, Los Angeles, Calif., whose territory includes Los Angeles, the southern part of California and all of Arizona; and A. J. Kroog Company, 208 Thompson Building, Atlanta, Ga., with territory in Alabama, and North and South Carolina.

New Subscription Order Card

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headings in our
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Water & Sewage Works

185 NORTH WABASH AVE. CHICAGO 1, ILL.

Gentlemen:

Please enter my new subscription to WATER & SEWAGE WORKS for the period checked below:

☐ Three Years—$6.00 ☐ Two Years—$4.50 ☐ One Year—$3.00

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708	709	710	711	712	713	714
715	716	717	718	719	720	721
722	723	724	725	726	727	728
729	730	731	732	733	734	735

IF YOU WISH TO RECEIVE FURTHER INFORMATION ON PRODUCTS ADVERTISED OR REFERRED TO IN THE ARTICLES, OF THIS ISSUE—LIST THE PAGE AND ITEM BELOW.

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JUST CLIP THESE CARDS MARK AND MAIL— TO RECEIVE THE LATEST INFORMATION OR LITERATURE DESCRIBED IN THIS ISSUE

READER SERVICE CARD for

WATER & SEWAGE WORKS

Equipment — Products
Information — Literature

Mr. Parkhurst, who heads his company, is a graduate of Rensselaer Polytechnic Institute and has been connected with the water works business since 1939. He was with the Rensselaer Valve Company, Troy, N. Y., from 1939 until 1947. He formed his company in 1948.

In addition to the Atlanta office of Kroog Company, covering the State of Georgia, the firm operates another company, Hanson Engineering Company, 700 Eighth Terrace, West Birmingham, Ala., covering the Alabama territory, and a third office at Charlotte, N. C., covering North Carolina.

B-I-F Appoints Hartley Gen. Manager Builder-Providence

B-I-F Industries, Inc., Providence, R. I. has announced the promotion of John R. Hartley to General Manager of their Builders-Providence, Inc., Division.

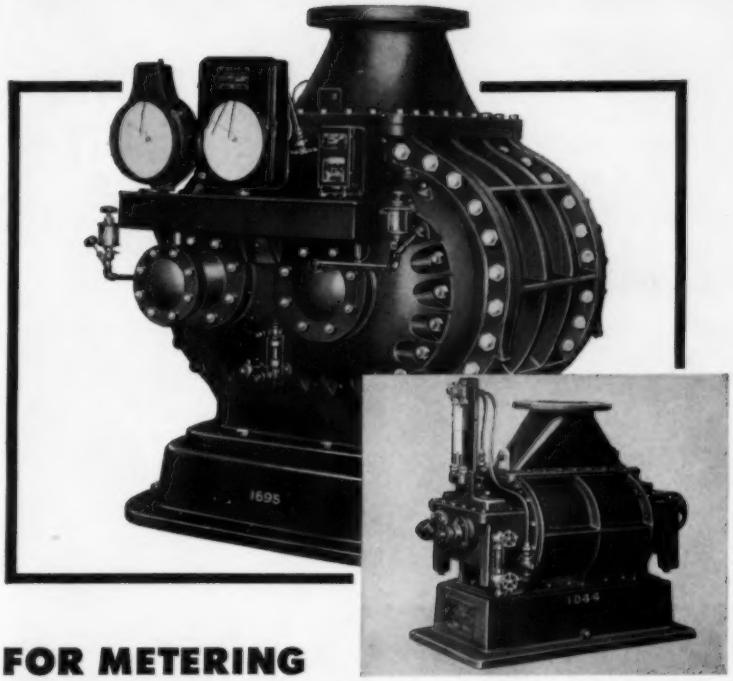
Mr. Hartley joined B-I-F Industries in 1929 and has been Vice-President and Manager of Project Sales since 1949. Now serving as president of the Providence Engineering Society, Mr. Hartley is a member of the American Society of Civil Engineers, the American Water Works Association, the New England Water Works Association, and the Boston Society of Civil Engineers.

Read Standard Promotes Finney

Read Standard Corp., York, Pa., has announced that William E. Finney, formerly sales engineer, has been named to the newly created post of Cleveland district manager. He will handle both engineering and sales responsibilities for the company's blower-stoker division throughout Ohio, eastern Michigan and eastern Indiana. Mr. Finney was formerly in charge of blower sales at the York plant, under C. J. Sturdy, vice-president in charge of sales for the blower-stoker division, New York City.

After serving with the U. S. Army Air Force from 1943 through

(*Continued on page* 116*A*)



FOR METERING

5,000 cfh or a MILLION

R-C *plur-ability*

PAYS DIVIDENDS

Look for R-C plur-ability in all your equipment to handle gas and air

Centrifugal and Rotary Positive Blowers, Gas Pumps and Exhausters

• • •

Spiraxial® Compressors

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Positive Displacement Vacuum Pumps and Meters

• • •

Inert Gas Generators

• • •

Ask for detailed bulletins on any R-C product—or write us your needs.

Packed into every Roots-Connersville Positive Displacement Gas Meter for measuring sludge gas are important values which mean *"plur-ability."* Summed up, they give you accuracy unmatched by any other type—that endures over many years of use. Maintenance is practically unknown, with no vanes, valves, or small parts. Compactness saves space and foundation cost. Capacities, pressures and overload ability fit your most exacting needs. If you need to measure sludge gas from 5,000 cfh to a million, you can trust the staying qualities of R-C Positive Displacement Meters. Ask for details in Bulletin M-152.

ROOTS-CONNERSVILLE BLOWER

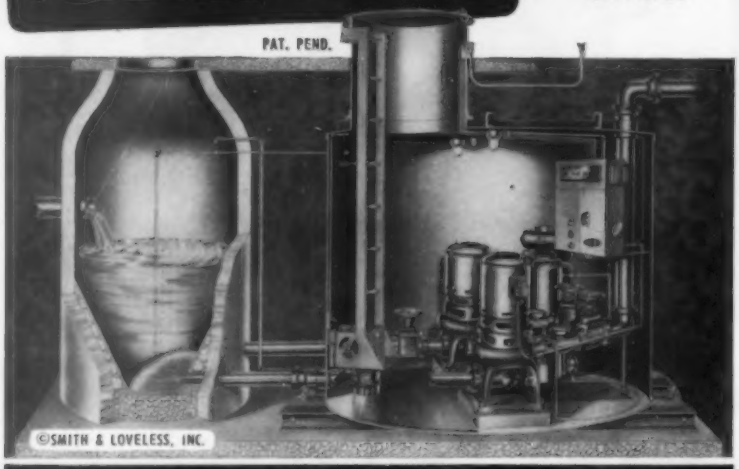
A DIVISION OF DRESSER INDUSTRIES, INC.

1155 Mount Ave., Connersville, Indiana. In Canada—629 Adelaide St., W., Toronto, Ont.

HUNDREDS OF INSTALLATIONS—IN 27 STATES!

Specify—
The Smith & Loveless
FACTORY-BUILT PUMPING STATION

PROVEN QUALITY—WITH FACTORY-BUILT SAVINGS



THE MOST ADVANCED DESIGN IN SEWAGE PUMPING STATIONS

We specialize in building America's finest sewage lift stations. Acceptance proves their quality. Smith & Loveless offer you a complete line of six standard size lift stations with capacities from 20 GPM to 1600 GPM per pump or ejector. Larger capacity stations are built to your order.

- An integrated design, each piece proven by the test of time.
- Precision assembled by factory experts.
- Automatic dehumidifier to eliminate condensation.
- A central electrical control cabinet prewired and color coded.
- Shot blasted steel structure epoxy coated plus cathodic protection.
- Factory tested and adjusted by actual operation before shipment.
- Easily and quickly installed.
- Especially designed for minimum maintenance.

For Job Recommendations, complete specifications, and drawings—all part of the latest edition of the 100 page Smith & Loveless lift station Data Manual . . .

WRITE DEPARTMENT 20

S&L *Smith & Loveless, Inc.*
P. O. BOX 8172 KANSAS CITY, MISSOURI
Manufacturing Plant • Merriam, Kansas

REPRESENTATIVES IN PRINCIPAL CITIES

1946, including two years of overseas duty in the South Pacific, Mr. Finney attended Rensselaer Polytechnic Institute, Troy, N. Y.,

Wemco Advances W. E. Galland

Western Machinery Company, San Francisco, Calif., has announced that W. E. Galland has assumed management of the Solids Pump Division. He replaces G. Y. Murray who will now head up Western Sales for the W.K.E. Division of the Company.

"Bud" Galland has worked with Gil Murray throughout the concentrated development of the Wemco Torque Flow Solids Pump Division. Following graduation from Tufts College, Mr. Galland spent ten years in pump sales, service and research in the East before joining the Wemco organization.

Gibbs Joins Smith-Blair Sales Staff

Smith-Blair, Inc., South San Francisco, Calif., has announced the appointment of Fred S. Gibbs to its sales engineering staff. He will be stationed at the company's South Gate, Los Angeles, California branch.

Mr. Gibbs, a native New Yorker, was connected with Fairbanks, Morse company for a period of ten years. He has been active in the Los Angeles Junior Chamber of Commerce and served as chairman of its Business and Commerce committee.

Fairbanks-Morse Elects Three

Fairbanks, Morse & Co., Chicago, Ill., has announced that at a recent meeting of the Board of Directors three new officers were added to the official family of the company. These are: Robert H. Morse, III, formerly Sales Manager, who was elected Vice President—Sales; D. L. Harwood, formerly General Purchasing Agent, who was elected Vice President—Purchases; and J. F. Weiffenbach, formerly Chief Product Engineer,

who was elected Director of Engineering.

Mr. Robert H. Morse, III was, for a number of years, General Manager of the company's Beloit, Wisconsin works, and later he was appointed Assistant to the Vice President in charge of Sales, which position he held for a number of years and was then promoted to Sales Manager.

Mr. D. L. Harwood has spent most of his life in the company's Purchasing Department as Buyer, Purchasing Agent and Manager of Materials and Schedules at the Beloit Works of the company. On January 1954 he was appointed General Purchasing Agent with headquarters in Chicago, which position he has held until the time of his present election to a Vice Presidency.

Jack Weiffenbach joined Fairbanks, Morse & Co. a number of years ago as Chief Engineer of the company's Diesel Locomotive Division. He later became Manager of Engineering at the Beloit Works, then Vice President in charge of Manufacturing of the Canadian Locomotive Company, Kingston, Canada, and then Works Manager of the same plant. In January of '53 he was appointed Chief Product Engineer with headquarters at Chicago, which position he has held until his present election to the position of Director of Engineering.

Hersey Meter Building New Plant

Hersey Manufacturing Co., South Boston, Mass., has announced that construction has started on a new and modern manufacturing plant for the company.

This plant, located on a ten-acre lot in Dedham, Mass., a suburb of Boston, will replace the present buildings in South Boston.

Cost of the new facilities will exceed $1,250,000, with completion scheduled for March 1957. Engineers and builders are the well-known Boston firm of Cabot, Cabot & Forbes and their building affiliate Aberthaw Construction Co.

Atlas Mineral Appoints Export Managers

The Atlas Mineral Products Co., Mertztown, Pa., has announced

Close Quarters?

Get a Hydrohoe

When close-quarter digging gets you in a corner, you can depend on a Bucyrus-Erie Hydrohoe to get you out — and at a saving in time and money.

This compact all-hydraulic truck-hoe with its extremely short tail swing not only speeds easy-to-get-at digging but also squeezes into narrow passageways, edges close to obstructions and moves dirt out in a hurry. You can trench out water and sewer lines, dig hydrant pits and manholes, excavate for catch basins — handle these and other jobs in locations where ordinary equipment just can't maneuver properly.

Extra advantages in close-quarter digging are provided by the Hydrohoe's telescoping boom and wrist-action dipper. Merely by extending and retracting the boom, the operator can regulate his digging ranges, permitting him to work in extremely close quarters. By working wrist action along with boom telescope, he can pry out objects obstructing digging . . . can work effectively around cross pipes.

Standard Hydrohoe dipper is 18" wide. Available as extra equipment are a narrow-type dipper, 12" wide, and wide-type dippers up to 60" wide, plus a special 20" utilities dipper designed to dig shorter trenches with greater depth than length. Optional remote control permits driving truck right from the Hydrohoe operating cab. Your Bucyrus-Erie distributor will be happy to arrange a demonstration on your job. 116H56

BUCYRUS-ERIE COMPANY
South Milwaukee, Wisconsin

BUCYRUS ERIE HYDROCRANE BUCYRUS ERIE HYDROHOE

Meet AWWA Specifications* for Tight Closure

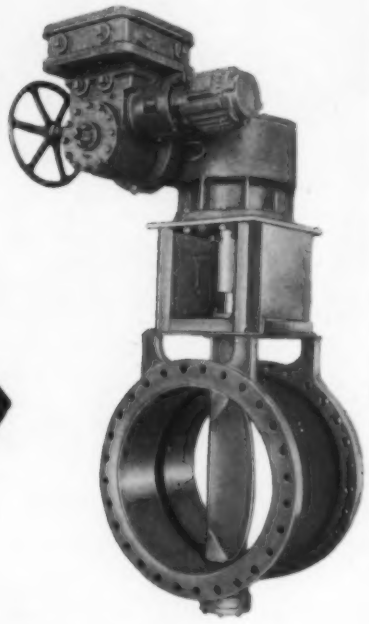
at Maximum Shut-off Pressures of 25, 50 and 125 psi

with your choice of

W. S. ROCKWELL

Flanged-End

BUTTERFLY VALVES



Rubber-Seated

Rubber-Lined

Both types in all sizes to 72". Manual operators – gear reducer with hand wheel or chain wheel; automatic operators—electric, hydraulic or pneumatic; for safe seating and unseating of valve disc at water velocity of 8 and 16 f.p.s.

A standard line of valves in sizes to 144" is available for other industrial, municipal and utilities requirements for tight shut-off or regulation of fluid flow. Write for Catalog.

**AWWA C-504-55T*

W. S. ROCKWELL COMPANY

BUTTERFLY VALVES • SLIDE VALVES • AUTOMATIC VALVES

2826 ELIOT STREET • FAIRFIELD, CONN.

Sales Representatives in Principal Cities

the appointment of Ballagh & Thrall, Inc., 1010 Schaff Bldg., 1505 Race St., Philadelphia 2, Pa., as export managers.

Ballagh & Thrall will manage the sale of all Atlas products for export to all countries except Mexico and the United Kingdom.

The Atlas account will be under the personal direction of Mr. Paul J. Marshall, a vice president of the firm.

Byron Jackson Pump Creates Sales and Service Co.

Byron Jackson Division, Borg-Warner Corporation, Los Angeles, Calif., has announced that the sales and service operations for Byron Jackson pump products are now being handled under the name Byron Jackson Pumps Inc., a new addition to the Byron Jackson group in Borg-Warner. The formation of the new corporation was announced by E. S. Dulin, president of the Division.

Mr. Dulin's statement explained that the new corporate entity was established to provide faster, more flexible operating procedures. "Except for these advantages," he said, "Byron Jackson Pumps, Inc. will maintain the same policies, personnel and locations with which Byron Jackson customers are already familiar." Addresses and telephone numbers of headquarters and field offices remain unchanged according to the announcement.

Bucyrus-Erie Names New Distributor for Southern Louisiana

Bucyrus-Erie Co., South Milwaukee, Wis. has announced that the Baton Rouge Equipment Company, Inc., Baton Rouge, La., has been appointed distributor in southern Louisiana. The firm will handle the full line of ⅜- to 4-cu. yd. convertible excavators and cranes; 15-ton and 25-ton capacity Transit Cranes; and dragline buckets.

The territory covered by Baton Rouge Equipment Company, Inc., lies south of and includes the following parishes: Beauregard, Allen, Evangeline, St. Landry, Pointe Coupee, West Feliciana, East Feliciana, St. Helena, Tangipahoa, and Washington.

Complete equipment servicing facilities and adequate parts stocks will be maintained at the new distributor's plant at 425 North Beck Street, P. O. Box 237, Baton Rouge, Louisiana.

W. S. Andrews Joins Dresser Manufacturing

Dresser Manufacturing Division, Dresser Industries, Bradford, Pa., has announced that William S. Andrews has joined the Company as Manager of General Markets Sales.

Mr. Andrews will manage sales of piping products to the water works field, petroleum, and process industries. He will also direct the promotion and sales of products through distribution outlets. Mr. Andrews will be headquartered at Bradford.

For the past 18 years, prior to joining Dresser, Mr. Andrews was district manager for Rockwell Manufacturing Company in the states of New York, Pennsylvania, New Jersey, Deleware, Maryland, Ohio, West Virginia, Eastern Kentucky, and District of Columbia.

Chicago Bridge Elects Hendren V. P.

Chicago Bridge & Iron Company, Chicago, Illinois, has announced that R. F. Hendren, Manager of Plants, has been elected a Vice President of the firm.

Mr Hendren, who is a graduate of the University of Kansas, started working for CB&I in 1923. He has been a Director of the company since 1946 and Manager of Plants since 1947.

Love Appointed Manager, Valve Div., W. S. Rockwell Co.

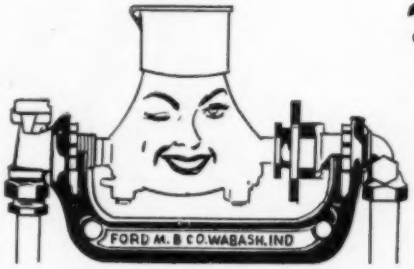
W. S. Rockwell Company, Fairfield, Connecticut, has announced that Richard E. Love was recently appointed Manager of the Valve Division.

Formerly a Sales Engineer and Field Representative for Minneapolis-Honeywell Regulator Company's Industrial Valve Division, Mr. Love has been in the control Valve field for the past ten years.

He is also a member of The American Society of Mechanical Engineers.

Fordin' Along...

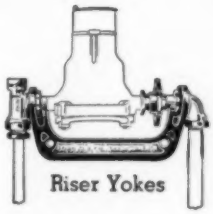
We commonly refer to water as H_2O, which indicates that each molecule is made up of one oxygen and two hydrogen atoms, but we find it difficult to comprehend the fantastic minuteness of the molecule itself. For example, there are more molecules in an ounce of water than there are ounces in all the oceans and seas of the earth. Assuming a reasonable amount of dispersion in almost two thousand years, every glass of water contains thousands of molecules from the six stone waterpots mentioned in John II as holding first water and then wine at the wedding feast at Cana in Galilee.



Meters Play

EASY-TO-GET

***when they wear* FORD YOKES**



Riser Yokes

Angle Yokes

Straight Line Yokes

Dress a meter up in a Ford Yoke and see what a difference it makes. No more fighting misalignment of pipes or wrong spacing between couplings. Just an easy twist of the wrist and you've got your meter.

Ask your meter man. He'll tell you that an easy-to-get meter can be kept more accurate so that it lasts longer and earns more revenue. Millions of Ford Yokes are in use.

Send for the Ford Catalog and learn more about getting your meter's worth.

FORD FOR BETTER WATER SERVICES

THE FORD METER BOX COMPANY, INC. Wabash, Indiana

BIG valve... little space

The disc in this 84-in. low pressure Butterfly Valve must withstand 138,000 lbs. of force when closed against a 25 P.S.I. line pressure . . . yet the face to face dimension is only 18 in. and the entire valve weighs just 12,000 lbs. Even under this severe loading Pratt design keeps the bearing pressure well below 2500 P.S.I.

Pratt Rubber Seat Butterfly Valves are manufactured in sizes from 10 in. to 168 in. in diameter, in pressure ratings up to 125 P.S.I. Their low initial cost, easy installation and proven low maintenance make them the logical solution to valving problems, both for new projects and as replacements.

The Henry Pratt Company originated and has been making this type of valve for over 28 years. Our background represents the greatest cumulative experience in the industry. It is the reason why Pratt Valves are so convenient to install, easy to operate and give long years of trouble-free service. **For full details write for Bulletin 1-C.**

HENRY PRATT

Send for informative booklet "Understanding Butterfly Valves."

RUBBER SEAT

Butterfly Valves

Henry Pratt Company, 2222 S. Halsted St., Chicago 8, Ill. Representatives in principal cities

Penn Instruments Promotes McQuade

Penn Instruments Div., Burgess-Manning Co., Philadelphia, Pa., has announced that R. A. McQuade has been appointed sales and advertising manager for the division.

Mr. McQuade has been with Penn Instruments for a year, as manager of Municipal sales. Prior to that he was with Simplex Valve & Meter Co., for 18 years as assistant sales manager, advertising manager and assistant secretary. He spent five years in Bombay, India, as a representative of Ingersoll-Rand Company, before joining Simplex.

Centriline Appoints Aycock Manager of Southeast District

Centriline Corporation, New York, N. Y., has announced the establishment of a new District office at 57 Forsyth Street, N.W., Atlanta 3, Georgia.

Mr. Milton H. (Cotton) Aycock has been appointed District Manager of the Southeast District to be served from Atlanta. Mr. Aycock is originally from Rocky Mount, North Carolina. Except for time spent in the U. S. Air Force during the war, he has been with Centriline continuously since 1941.

Worthington Corp. Acquires Mason-Nielan Regulator

Worthington Corp., Harrison, N. J., has announced the transfer of the net assets, name and goodwill of Mason-Neilan Regulator Co., Boston, Mass., in exchange for Worthington common stock.

The Mason-Neilan plant and facilities will be operated as the Mason-Neilan Division of Worthington Corp., and the entire working force and management staff will be continued in their present positions.

The new division will be located in a new manufacturing plant in Norwood, Mass., which the Mason-Neilan Regulator Co. acquired recently.

Literature & Catalogs

Water Filters

712

Graver Water Conditioning Co., New York, N.Y. now has available copies of a Bulletin on **Water Filters, Pressure Type.**

This 12-page, fully illustrated bulletin completely describes the uses, design features and engineering details of pressure sand and gravel filters.

Details of all accessory equipment, the different types of controls available and a detailed table giving capacities, sizes and space requirements are included. Cutaway views of both horizontal and vertical filters are shown as well as details of strainers, distributor systems and piping arrangements.

Aerial Surveys

713

Abrams Aerial Survey Corp., Lansing, Michigan, has just released an 8-page brochure **"Serving the Engineering Profession"**, that explains and illustrates mapping by use of aerial photography and photogrammetry.

The brochure includes examples of topographic maps of 1-ft precision, planimetric, photographic mosaic maps and plan and profile sheets as products of the airborne camera.

Electric Tool Catalog

714

Thor Power Tool Company, Aurora, Illinois, has published a new universal **Electric Tool Catalog.**

Thor's complete line of Silver Line and Speed Tool Electric tools for use in the automotive, industrial, construction, maintenance, trade crafts and home workshop fields, is illustrated and described in the 44-page publication which is printed in two colors.

Complete specifications and information are given on a number of tools Thor has introduced during the past six months.

A typical page of the catalog shows an actual photograph of a basic Thor tool with sub-illustrations picturing the tool in use. There are also complete descriptive matter on the tool and its related models together with specification tables and other technical information. There is a full listing of attachments, accessories and replacement parts available with all tools.

A grain elevator gets a good going over, *INSIDE, OUTSIDE!*

COMPLETE BREAK-THROUGH IN WALL

How to save this costly structure, without rebuilding sections, presented a serious problem.

Workmen on scaffolds, from inside and outside, cut out deteriorated concrete.

Necessity of costly forming was eliminated by the use of THORITE 20-minute set, nonshrink, filling and patching mortar.

THORITE

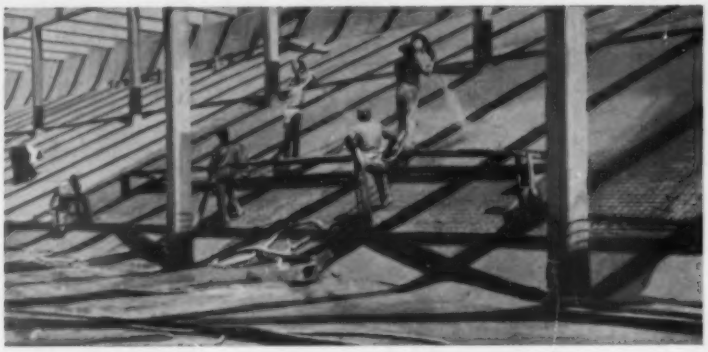
THORITE permits completion of job in one fall of scaffold, followed immediately by THOROSEAL seal coat.

Air hammers cut away loose and crumbling concrete. THORITE formed into cleaned-out sections, with a minimum labor cost, restored elevators to original condition.

Job completed with the application of THOROSEAL over entire structure.

Get our 16-PAGE CIRCULAR

STANDARD DRY WALL PRODUCTS, INC.
NEW EAGLE, PA. • CENTERVILLE, IND.

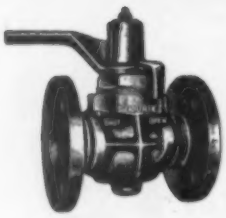


"GUNITE" Lining Restores Reservoir

When the old, open Ballou Park Reservoir at Danville, Va., was improved and covered, excessive leakage of the old brick lining was stopped with reinforced "GUNITE". The photo shows details of the process. After concrete columns to support the roof were placed, wire mesh reinforcing was laid and the entire reservoir was "GUNITED". Note that the reinforcing and "GUNITE" were carried over the column footings and up the columns approximately three feet to prevent leaking at those points.

The use of "GUNITE" for repair and construction of reservoirs, bridges, buildings, C3000. We will gladly send a copy at your request. On your letterhead, please. etc., is illustrated and described in Bulletin

CEMENT GUN COMPANY
"GUNITE" CONTRACTORS
GENERAL OFFICES – ALLENTOWN, PA., U. S. A.
MANUFACTURERS OF THE CEMENT GUN



On all lines, from heavy sludge to gas, DeZurik plug valves perform with equal excellence. They open and close easily—note the short operating levers—and they don't leak! Write for more details on these non-lubricated, low-maintenance valves. Representatives in principal cities.

DeZURIK SHOWER COMPANY
SARTELL, MINNESOTA

Wrought Iron Fittings And Flanges

715

Tube Turns, Louisville, Ky., a division of the National Cylinder Gas Company, has just published a new folder describing Tube-Turn **Wrought Iron Welding Fittings and Flanges.**

The folder gives dimensional data on Tube-Turn products in sizes from ½" through 12", discusses the physical properties of the material, and illustrates typical applications.

Tube-Turn wrought iron welding fittings and flanges are stocked by distributors in all major industrial areas.

Control Regulating Valves

716

Copes-Vulcan Division, Blaw-Knox Co., Erie, Pa., has available a bulletin which describes two new basic **Control Regulating Valves** with greater versatility and wider application.

The bulletin states that the valves—diaphragm-type, CV-D, and piston-type, CV-P—will handle water, steam, air, gas, oil or other similar fluids at unlimited pressures.

A complete description of the valves is given, including the specifications for each valve and information on pressure reducing and desuperheating stations along with package controls.

G-E Catalog For Low-Voltage Electrical Distribution Equipment

717

General Electric's Trumbull Components and Distribution Assemblies Departments, Plainville, Connecticut, has just released a new 1956-57 general catalog of **Low-Voltage Electrical Distribution Equipment and Components.**

The 160-page, two-color publication provides a single, bound reference for the products manufactured by these two G-E departments. It is designed to provide engineers, contractors and purchasing agents with a reliable source of information for specifying electrical power distribution equipment and components for applications up to 600 volts.

The new catalog contains photos, descriptions, ratings, list prices and application information on the following General Electric product lines: lighting and distribution panelboards, wireways and busways, switchboards, motor control

Another NEW Leopold Installation...

New 48 mgd Columbus, Ohio plant equipped with Leopold Filter Bottoms

In addition to this recent installation, Leopold Compound Duplex Filter Bottoms are giving dependable, economical performance in well over 300 plants (with a daily capacity of more than 1¾ billion gallons). And the number of Leopold-equipped facilities is growing by leaps and bounds. For example, Leopold Bottoms have been specified for the five largest plants now being built in this country.

Whether you're modernizing your present plant or planning new construction, it will pay you to consider the many features offered only by Leopold Tile Filter Bottoms. They resist corrosion, are not subject to tuberculation, require only small sized gravel, are acid and alkali resistant, provide equal and uniform filtration, and will last indefinitely. Want more details? Write us today.

For TOP performance, use Leopold Bottoms

Leopold

F. B. LEOPOLD CO., INC.
2413 W. Carson Street
Pittsburgh 4, Pa.

COMPLETE WATER PURIFICATION AND SEWAGE PLANT EQUIPMENT!

centers, distribution center unit substations, safety switches, open knife switches, molded case circuit breakers and service entrance equipment.

Dorrco Clariflocculator
718

Dorr-Oliver Incorporated Stamford, Conn., has announced the availability of a new, twelve-page, two-color bulletin, **The Dorrco Clariflocculator.**

The bulletin describes the physical characteristics, principle of operation, types, sizes and advantages of this combination flocculation and clarification mechanism. Also included are photographs of operating installations and line and wash drawings of standard units.

According to the bulletin the Dorrco Clariflocculator is a combination unit providing flocculation and clarification in a single tank. It is applicable to the treatment of water, sewage, and industrial wastes, as well as to various operations in the chemical process industries. The unit comprises a flocculation compartment with both rotating and stationary vertical paddles annularly surrounded by a mechanically cleaned clarification chamber.

Mixers and Coagulators
719

Infilco Inc., Tucson, Ariz., has released a bulletin on **Mixers and Coagulators** that eliminates guesswork in selecting liquid mixing and coagulating equipment.

How to select proper equipment of this type and the advantages of "VORTI" mixers and "VORTI-FLOC" coagulators are outlined in this eight-page illustrated bulletin.

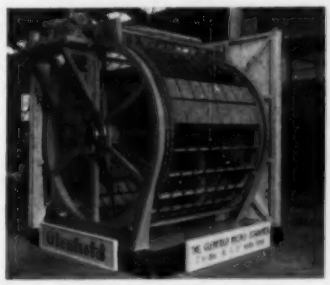
The bulletin states that the "Vorti-Floc" coagulator is designed for use in the chemical treatment of water, wastes and sewage, or for accomplishing self-coagulation. It moves the liquid horizontally and vertically thus eliminating stratification. Power consumption of the "Vorti" mixer and "Vorti-Floc" coagulator is low because of the manner in which the impeller moves large quantities at relatively low velocities.

Prepackaged Pump Service
720

Peerless Pump Div., Food Machinery & Chemical Corp., Los Angeles, Calif., has just published a

(*Continued on page 124A*)

If you did not see

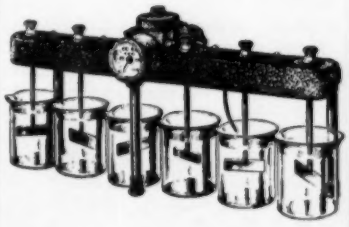


The GLENFIELD Micro-Strainer at the AWWA St. Louis Convention

. . we suggest that you write us for a copy of our latest literature

GLENFIELD AND KENNEDY, INC.
706 North Ave., New Rochelle, N.Y.

P & B Multiple Stirrer



When several samples are mixed simultaneously under identical conditions the optimum concentration of flocculent may be quickly selected and translated to plant quantities . . . The mixer takes 1,000 ml. beakers. Speeds from 15 to 100 r.p.m. are standard.

Write: **Cat. No. 77-700**

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MANUFACTURING CO.

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DARBY, PA.

New
FINE SCREEN
systems for
SEWAGE TREATMENT
. . . eliminate costly handling of sludge.

Modern **FINE SCREEN** systems replace primary settling, costly sludge pumps and vast sludge drying beds. A modern **FINE SCREEN** system means the latest methods and designs in mechanical filter screens, sludge de-watering, and incineration . . . with complete destruction of all sludge and garbage. A new **FINE SCREEN** system will give you a cleaner operation in a fraction of the space, and at a lower cost to the community.

FINE SCREEN primary treatment is often all that is necessary for sewage treatment in some communities.

As pioneers in **FINE SCREEN** design, let us show you the system to fit your needs. Write today for further information.

VARSITY ENGINEERING
INCORPORATED
207 SO. ASHLEY ST.
ANN ARBOR, MICH.

bulletin describing how the company has prepackaged 22 job-sized, end-suction pumps in reinforced cartons for easy stacking and storing under their **"Redi-Pak" Fluidyne** label.

The bulletin contains complete pump descriptions and an easy-to-order-from selection chart. It also includes head-capacity performance curves for each of the 22 pumps. Also stressed is the quick availability of these pumps, with Peerless plants, warehouses and branch offices stocking an ample supply of all models to provide "order today—pick-up today" service.

Swimming Pool Data Book

721

Modern Swimming Pool Co., Inc., White Plains, N. Y., has available a **Catalog and Data Book** of swimming pool supplies and equipment. It is a 52-page book, profusely illustrated, containing data, photographs and prices of every item needed to build a new residential or public pool, or to equip and maintain an existing pool. There is a section on proper pool care and maintenance, and detailed descriptions of approved water-treatment chemicals. "Ber-Kite"—a new compound for the control of algae in reservoirs, lakes and swimming pools—is included in this section.

This data book is designed to be helpful to commissioners, superintendents, managers and directors of water works and water companies as well as sanitary, city and consulting engineers and municipal purchasing agents interested in economical sources of supply for swimming pool chemicals and equipment. It gives working drawings, descriptions and prices of a complete range of swimming pool equipment.

Servicing
Water Holders
All Types
Elevated and
Standpipes.
Specially designed materials that hold down corrosion.

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All guaranteed work

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Complete Painting & Repair Service
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Surer Gland Lubrication for Centrifugal Pumps

THE Z-F GREASE SEAL eliminates that trouble spot where shaft enters casing. Applies constant positive lubrication to packing and shaft—automatically. Excessive heat, rapid wear, leakage and scoring will disappear as the Grease Seal applies a constant flow of lubrication when pump starts until it stops—automatically. Many other advantages, too. Write for complete description and price. **ZIMMER and FRANCESCON, Moline, Illinois.**

ZF

Revised AWWA Specifications For Rubber-Seated Butterfly Valves

722

Builders-Providence, Inc., division of B-I-F Industries, Inc., Providence, R. I., offers free reprints of **Tentative Standard Specifications for Rubber-Seated Butterfly Valves.**

Prepared by the American Water Works Association, this newly revised, eleven page pamphlet covers cast-iron and steel, flanged-end, rubber seat, tight-closure butterfly valves, 3 to 72 inches in size, for line velocities not exceeding 16 fps. Torque requirements for operators are included and these specifications cover the most adverse conditions, such as frequent operation, operation after long periods of idleness, and operation in a throttled position in water lines. Sections on materials of construction, mechanical components, testing, workmanship, marking, painting, inspection and rejection are also included in this pamphlet.

Mechanical Jointed Clay Pipe

723

American Vitrified Products Co., Cleveland, Ohio, has just released a folder describing **Amvit Jointed Vitrified Clay Pipe.**

The folder describes the new pipe, in sizes 4 through 24 inches, as a true "built-in" mechanical joint ready for immediate, quick and easy installation. According to the bulletin, Amvit is infiltration and root-proof, permits immediate backfilling and testing, offers better flow and less maintenance, permits deflection, absorbs shocks, and permits a bottle tight line if desired

A series of installation photographs are also included.

Equipment & Methods for Modern Sewage Treatment

724

Dorr-Oliver Incorporated, Stamford, Conn., has just published a new, twelve page, two-color bulletin, **Dorr-Oliver Equipment and Methods for Modern Sewage Treatment.**

The bulletin briefly describes the distinguishing characteristics, types, sizes, applications and operation of major Dorr-Oliver sewage treatment equipment and presents a number of typical plant flowsheets. Also included are

(*Continued on page 126A*)

Today's Facts on Modern **SEWAGE EJECTION**

Blackburn-Smith Mfg. Co., Inc.
51 Garden Street, Hoboken, N. J.
I want to know how I can get better sewage ejection at lower cost.
Name .....
Company .....
Address .....

Features of BLACKBURN-SMITH EJECTORS
Switches operated automatically by float and electrical controls.
Snap-action valve controlled automatically, pneumatically and by float. Electrode controls.
Compact . . . motor compressor assembly and controls in "one package" unit.
Steel construction. Welded steel pots.
Simple piping for air, water.
No clogging screens, impellers, shredders.
No messy pump cleaning. Sanitary.
Unfailing, dependable operation.

BULLETIN S-50
for look-ahead municipal engineers

Get the facts you want on how to eliminate costly, complex piping for air and water, messy, unsanitary screens, impellers, shredders, expensive pump cleaning . . . in short, the facts on simple, dependable, economical, clean Blackburn-Smith Ejectors. Valves and switches are controlled automatically for unfailing operation by electricity, by floats, and by pneumatic action. Learn how simple, compact, and inexpensive they are to install, operate, and maintain compared to complicated systems. Get today's facts today—Send the coupon in now!

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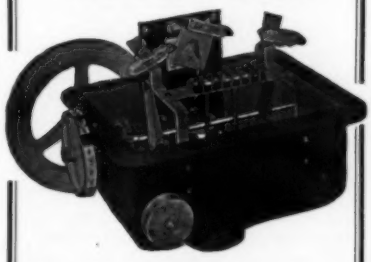
ROTO-TROL



RF-2

WITH ALTO-TROL

This 2-pump RF-2 Roto-Trol assures equal use and wear of both pumps. Each pump is operated on alternate starting cycles.

The RF-2 operates both pumps together, when required. RF-2 installations give dependable service year after year, with the minimum of attention.

Write for full data

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HEALY-RUFF COMPANY
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PRESSURE CONCRETE CO.

gives cement greater utility, versatility!

FOR REPAIRING: Reservoirs, Dams, Filter Plants, Sewage Disposal Plants, Tanks, Stadiums, Bridges, Sea Walls, Breakwaters.

FOR LINING: Reservoirs, Swimming Pools, Tunnels, Sewers, Pipe, Concrete, Brick and Steel Tanks, Stacks, Bunkers, Irrigation Ditches.

FOR CONSTRUCTING: New Tanks, Stacks, Piles, Sidewalls and Roofs, Steel Encasements.

Write for 48-page illustrated booklet showing "GUNITE" at work.

PRESSURE CONCRETE CO.

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CHARLOTTE, N. C. — Liberty Life Bldg.
FLORENCE, ALA. — 315 So. Court Street

WILKINSON LINE LOCATOR . . . sees where you can't

Instantly spots every underground location

Registers depth of pipes and cables
NEW long life cases

NEW printed circuits. NEW Antennas—more power.

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Trade Mark Reg. U.S. Pat. Off.

THE MODERN ALL-PURPOSE
FILTERING MEDIUM

Best for All Types of Filters

ANTHRAFILT
offers important advantages over sand and quartz

DOUBLES length of filter runs.
REQUIRES only half as much wash water.
KEEPS filters in service over longer periods.
INCREASES filter output with better quality effluent.
GIVES better support to synthetic resins.
PROVIDES better removal of fibrous materials, bacteria, micro-organic matter, taste, odor, etc.
IDEAL for industrial acid and alkaline solutions.
EFFECTIVE filtration from entire bed.
LESS coating, caking or balling with mud, lime, iron or manganese.

Write for further information, test samples and quotations to:

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Representing
ANTHRACITE EQUIPMENT CORP.
Anthracite Institute Bldg.,
Wilkes-Barre, Pa.

photographs and line and wash drawings of various units.

The bulletin states that regardless of plant size, type of treatment desired or local conditions involved, there is D-O equipment available for every sewage treatment installation. The eight flowsheets included in the publication range from simple primary treatment through intermediate and complete treatment. Plant performance to be expected using each of the flowsheets is tabulated, indicating average B. O. D. and suspended solids removal in each instance. Statements outlining the particular application of each of the flowsheets are also included.

Steel Water Lines Report

725

Dresser Manufacturing Division, Dresser Industries, Bradford, Pennsylvania, has released its ninth annual issue of **"A Report of Dresser-Coupled Steel Water Lines."** This attractive, 12-page illustrated report carries construction details on principal steel water lines laid during the past year.

The lines described vary in diameter from 4" to 67", and are reported from all sections of the United States, as well as Alaska, Canada and South America.

Waterworks engineers and contractors interested in latest developments in water line construction methods and materials will find this report of value.

Elevated Steel Tanks

726

R. D. Cole Manufacturing Co., Newnan, Ga., has available an attractive 2-color bulletin on **Cole Shallow-Depth Steel Tanks.**

The bulletin discusses the Cole "Ovaloid" tank and its construction advantages. Several photographs of this type of tank, recently constructed for the City of Greensboro, N. C. are shown. A dimensional drawing and capacities and size chart complete the bulletin.

"Flick of The Wrist" Valve Operation

727

Golden Anderson Valve Specialty Co., Pittsburgh, Pa., has just published a bulletin entitled **"It's Easier To Open Or Close A Golden-Anderson Valve Than To Drive A Car With Power Steering".**

This attractive 2-color bulletin explains, by means of simple text-keyed drawings, how line pressure furnishes the power to open or close Golden-Anderson valves—no manual effort, no handwheels, no motors, or levers are needed.

Different types of G-A valves, using the piston operating principle, are included in the bulletin along with a general discussion of the materials, workmanship, and construction.

Industrial Filtration

728

R. P. Adams Co., Inc., Buffalo, N. Y., has just released a 10-page bulletin on **How Industrial Filters Can Lower Production Costs.** Several simple case histories—from filtering city water . . . to the filtering of recirculation water from cooling towers and spray ponds—are cited.

Adam's new line of IWF filters is featured in this bulletin. Data on the IWF includes sectional views in three colors, typical installation drawings, dimension charts and four color operational diagrams. Also included are three color sectional illustrations of the well known Adams AWF Automatic Filter, and the popular WFF and WFS series filters.

HYDRO-TITE

DEPENDABLE JOINTING COMPOUND
Seals Bell and Spigot Water Mains
Economical—Effective
Over 35 Years Of Dependable Performance

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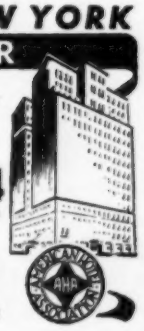

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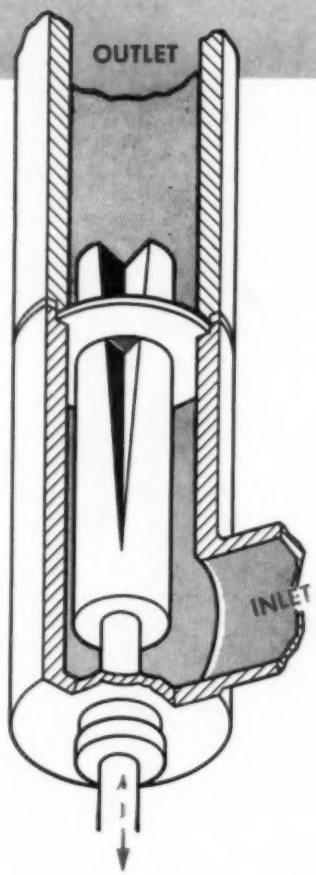

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